COAL AGE

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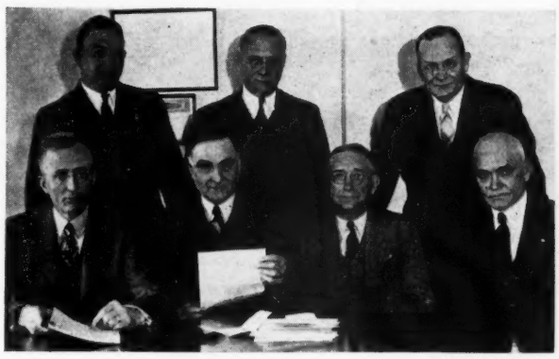
SYDNEY A. HALE, Editor
R. DAWSON HALL IVAN A. GIVEN J. H. EDWARDS
LOUIS C. McCARTHY WALTER M. DAKE PAUL WOOTON
A. W. FISHER, Manager



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Harris & Ewing

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● **What** makes mechanization an outstanding success in one mine and only so-so at another? First and foremost, a thorough understanding of the primary factors affecting loader-machine application. Walter Dake, who spent years supervising loader installations throughout the country, analyzes these factors and methods for accurately determining net cost savings under varying physical and operating conditions in an article scheduled for early publication.

● **Long-hole shooting** of pillars is attracting increasing attention in the southern anthracite field. With this system, the need for pillar holing is eliminated. Long shots are fired together from all cross headings, entirely demolishing the pillars, saving time, labor and timber, increasing safety and providing more large coal and better recovery. Details of this system are told on page 349.

● **Mine power** here, purchased power there. Coal Age has published several articles on mines which built new or modernized old plants for the generation of their own power; next month it will relate the story of the abandonment of one of the few remaining 25-cycle private plants in favor of purchased power. Other changes accompanying this Glen White move also will be described.

● **Experience** may be a dear schoolmaster, but sometimes its lessons offer the only basis for further improvement. Gauley Mountain Coal Co.'s experience with monitors is a case in point. Profiting from earlier installations, Gauley Mountain now has a combination monitor and supply hoist plane to handle men and materials, with regenerative braking of the monitors on their downward course. The story starts on page 357.

● **Lightning** strikes in a millionth of a second, but causes damage to electrical equipment which may take days or weeks to repair. Operations in mountainous country are particularly vulnerable because of the equipment exposed to the elements. How to protect coal-mine circuits from such attacks will be outlined by C. T. Pearce and R. C. Allen, of Westinghouse, in September.

● **A convention report** in miniature would not be an inapt description of this month's news section. Safety discussions of the Mine Inspectors' Institute meeting are summarized on page 375; Nova Scotia Mining Society convention highspots appear on page 379; A.S.T.M. coal deliberations are told on page 381; the first major hearing of the Bituminous Coal Commission is reported on page 373.

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Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

Any way

COAL AGE

Established 1911—McGraw-Hill Publishing Company, Inc.

DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

August, 1937

Social Responsibility

EMPHASIS has been laid on the social obligations of those industries which employ the bulk of the labor. A small employer can lay off men right and left with no public reprobation. But when a large industrial concern or an industry employing a host of men is harried by the loss of markets and begins to shut down units or reduce its payrolls, it is damned, subjected to all manner of illegal reprisals—such as bootlegging—and is held to be without defense for its actions.

Surely the public which refuses to buy or shifts its patronage is more violative of social responsibility than the producer who, getting no orders, begins to restrict his labor in keeping with the volume of product demanded. Either there is no such social responsibility or it rests upon everyone. The miner in that case is under obligation to the storekeeper to go on buying regardless of failing income, just as the producer is under obligation to continue producing despite the loss of market. Social responsibility is the term coined by all classes of men to regulate businesses other than their own.

Self-Interest

IN MANY WAYS acid water harms the coal producer almost as much as it does the public, for it increases his operating costs. To decrease stream pollution, water should be prevented as far as possible from entering mines. This accords with the best interests of the mine owner, who often is pumping water which he could more cheaply divert from the mines by flumes and other waterways. Moreover, by careful removal of pillars he can break the roof in large masses with crevices that will heal as mining progresses, and large portions of abandoned areas will cave so completely that no air can enter them to create acidity. Methane, if present, will not collect to trouble him.

Traveling down crevices from surface to mine workings, water gathers acid from higher seams of coal and boney and also from shales and clays, which are rarely so free of pyrite as is commonly assumed. Arriving at the workings, the acid burden is increased by pyrite in heaved floor, crushed pillars, gobs and fallen roof coal. When this acid water is pumped, maintenance cost is sure to be high, and the highest acidity usually is found in the mines having the most water. Surely it is the height of prudence for the operator to cooperate with the public—at least so far as will reduce his own costs.

No Pussyfooting

WHETHER the mechanization commission set up under the present Appalachian wage agreement contributes to a better understanding of a question upon which there has been much loose thinking depends largely upon the frankness with which the study is approached. Admittedly the problem is not a simple one. Its ultimate solution demands careful weighing of involved social and economic factors as well as inter-industry competitive situations, a fine balancing of abstract equities with palpable necessities.

Emphasis is placed on frankness, however,

for two reasons. The machine, first hailed as the liberator of labor from drudgery, is now held up by certain groups who have wrapped themselves in the robes of acute social consciousness as the author of most, if not all, of our industrial ills of the past few years. Too many industrialists—and coal is not without its quota—meet the issue thus raised with silence; "let sleeping dogs lie" is their motto.

This may be a delightful theory, but it ignores the rather important fact that these metaphorical canines already have been aroused from their slumbers and now frighten the timid with their baying. All silence and concealment on the part of those who believe in mechanization can do is to make the baying more horrendous. Such a policy means an open field for propagandists more concerned with embellishing a story than with making an impartial study and appraisal of the facts.

Forward Moves

BITUMINOUS PRODUCERS, acting through the National Coal Association, have started a long-needed promotional program. The initial campaign, launched in cooperation with the Stoker Manufacturers' Association, is aimed at the small-home owners and carries the story of the comfort and convenience of modernized heating with soft coal. Plans have been made to supplement publication advertising with nation-wide distribution of promotional literature through operators, retailers, heating-equipment manufacturers, engineers and architects.

During recent years many organizations have been studying coal-combustion problems and equipment. Much worth-while fundamental research and engineering work has been done and more is in prospect. But the job of capitalizing on the results of these activities and of turning them into sales tools has been piecemeal and inadequate because no machinery had been set up to carry the story to the general public. This weakness the new campaign promises to correct. With all interests giving whole-hearted support, such correction can be achieved.

Hard-coal producers inaugurated a somewhat similar program in their major consuming markets late last year through Anthracite Industries, Inc., and that campaign is continuing. While, in a narrow sense, these two programs are competitive, in the larger sense they are complementary. Both bring the story of solid fuels to a buying public that too long has been told that King Coal is dead. Persistent mass publicity should convince consumers that the regal gentleman has not even abdicated.

Pilfering's Scale

BOOTLEG MINERS recently struck against nineteen bootleg breakers because those plants would not pay enough for coal. Now, for coal stolen from the legitimate companies, the bootleg breakers, it is reported, must pay one-half cent per cubic foot more than before. Thus 1,500 miners are going back to take "what isn't 'isn" at a rate of seven cents per cubic foot—after a successful struggle for their "rights." Why they should have been allowed to return to their pilfering at all is hard for an outsider to comprehend—or is it only those who mine legally who should be prevented from working?

Reliability and Safety

IN GERMANY a single word, "sicherheit," serves for both safety and reliability, thus strongly suggesting that nothing is safe that is not reliable and nothing reliable that is not safe. The word covers also the ideas of guarantee, surety, certainty and firmness. May not the mining public perhaps, learn in this a lesson in operation?

Loose-ended methods, as many companies have discovered, lead neither to reliability nor safety. Freedom from lost-time accidents to equipment they find, at least in part, means freedom from such accidents to men. When a failure of equipment occurs it cannot be dismissed, they think, as merely an operating problem. In most cases it also involves danger to men. A trip leaves the rails and plunges into the rib. It may injure no one, but the potentiality of injury to life and limb is there and the accident needs as close consideration from the casualty viewpoint as one in which men were hurt.

LONG-HOLE VOLLEY SHOOTING

+ Demolishes Pitching Pillars

At Westwood Colliery

By R. DAWSON HALL
Engineering Editor, Coal Age

"LABORIOUS, expensive, slow, unsafe, wasteful in a degree of coal, very wasteful of timber and presenting ventilation difficulties, is the pillar-hole or pillar-breast method of removing the pillars of pitching seams," declared C. E. Miller, superintendent of a colliery which has set standards for others to follow in the anthracite field. His method, known as the long-hole system, can be successfully adopted wherever the pitch is 30 deg. or more and the roof is strong enough to resist extensive caving. Moreover, if roof or bottom is weak, modifications can be provided. Already the long-hole system has been adopted in the withdrawal of 200 full-length breast pillars.

In an old, much-quoted recipe for making hare soup, the leading item is "first catch your hare." Mr. Miller's program faces that proposition, for the removal of pillars had to await the driving of breasts to form pillars, and there are at his mines at present no pillars to draw.

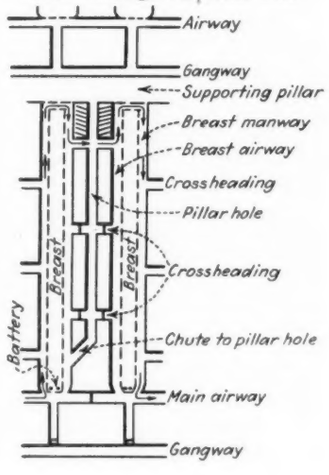
In most anthracite mines, hitherto, there has been an abundance, for the work of removing pillars was so long and difficult that often the pillars were not drawn for some time after the breasts had been driven. In fact, at first they were invariably left and then later were removed if convenient, and still safe, to draw. Parts of pillars often were left if the job proved too hazardous.

These temporarily abandoned pillars have proved bonanzas for bootleggers and strippers working from the surface, for the miners and dragline excavators, and in a degree the shovelmen, found that the presence of the breasts provided drainage, and the bootleggers soon discovered that they provided ventilation also, without which operation by a single opening is exceedingly hazardous, especially where, owing to lack of drainage, gasoline pumps must be taken below ground to dewater these improvised workings.

The first operation in extracting a thick pillar usually was and is to drive up a chute hole or narrow breast between the main breasts and in the heart of the pillar. This breast started usually with a chute near the airway of the level and proceeded upward painfully from this airway to the next gangway, or level, above it, the miner carefully timbering it as he proceeded. In fact he might drive it, not merely from the airway but from the level below it, if it was not thought too hazardous to weaken further the upper pillar of the gangway, which frequently could not be done with safety. If such a breach through the gangway pillar was not permissible, the lower end of the pillar hole had a blind end or the miner had, as stated, to direct the coal from the pillar hole by a chute to the main breast.

Driving such a pillar hole and chute was none too safe, for the pillar had been for some time under

Pillar drawn by driving up pillar hole and shooting coal from hole

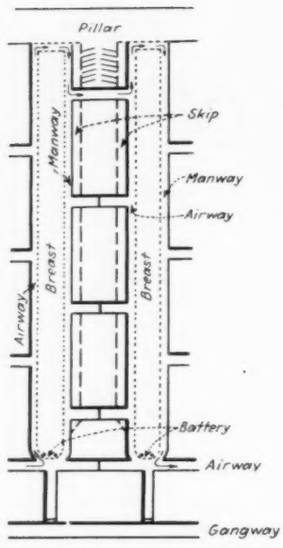


weight, and by the time the pillar hole was completed this weight might have creviced the coal and rendered the pillar hole difficult to sustain. The driving of the pillar hole and chute also further weakened the pillar.

When the pillar hole approached a crossheading, or crosscut, conditions became still more hazardous, and the work of timbering past the crossheading was a labor of real peril. Thus it happened, in driving toward the outcrop, that many a pillar hole was abandoned before the upper end of the pillar was reached, leaving the rest of the coal in place, without thought, in earlier days, of ultimate recovery.

Some companies tried to reach the top of the standing pillar by driving a skip up the side of the latter. Having a loose end, the coal in the skip dug more easily than would the same coal in a pillar hole, but the support of the skipped place was still more difficult, and two places, one on each side of the pillar, were necessary, adding to the peril.

After the pillar thus was holed or skipped, as the case might be, drillholes were driven at intervals into the pillars from the breast or skip, from the pillar hole or from both breast and pillar hole, as conditions favored. These holes usually pitched upward about 20 deg. Each hole then was duly charged and stemmed; and the shots were lighted all at one time and fired and the entire pillar or much of it destroyed —another unsafe procedure, for who could be sure that the top shot would not explode before the miner had time to light the lowest one and retreat from the place of danger? Moreover, one shot might go out of turn before its load was lifted. At



Pillar removed by driving skips up pillar sides and shooting coal from skips

times, however, the coal was loosened by sections, short or long. In fact, sectional shooting was more general than the simultaneous shooting of all the units of the entire pillar just described. In Mr. Miller's mine, simultaneous, or volley, shooting has always been customary.

Explosive manufacturers with their electric fuses helped this situation. There was less danger by far when all the shots could be fired simultaneously from the level below with the aid of a battery, and there also was more assurance that all the shots would be fired. Delay detonators also assured that the shots would explode in due order, some being delayed until others had decreased the load on them.

In central holing or skipping, much timber was introduced; this was expensive, and it blocked the drawing of the dislodged coal and also prevented it from passing down the breast. Thus, the entire job was badly and perilously performed.

Hence the long-hole method. J. L. G. Weisser, then an instructor at Lehigh University and now an engineer for the Lehigh Navigation Coal Co., devised a long-hole system. He proposed that long holes be drilled from the upper gangway to the airway of the lower gangway, loaded and fired by sections. About a year later, all unaware of this earlier proposal, which never had even been tried or published, Mr. Miller devised a somewhat different method and undertook to put it in operation at the Westwood colliery, then operated by the Hazle Brook Coal Co. This colliery is located some four miles to the west of Tremont in the Southern Anthracite Field.

Cost of Shooting a Pillar by Long-Hole Method

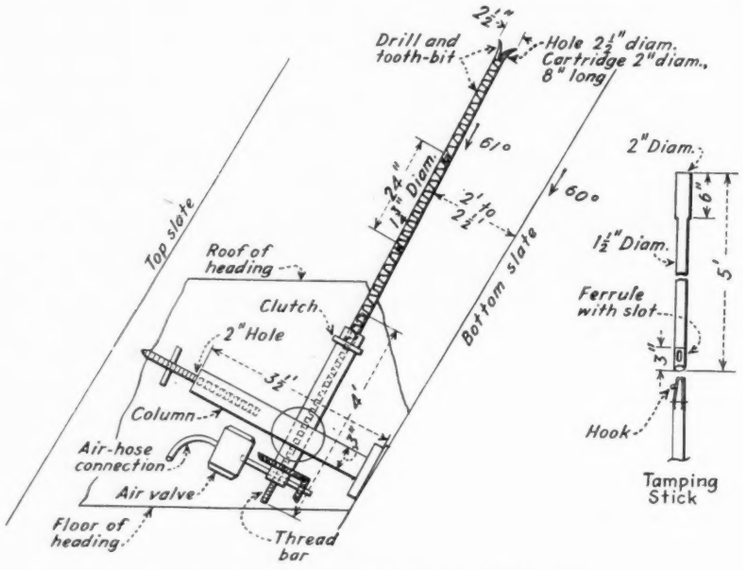
Labor

16 hr. transporting equipment and powder	
16 hr. setting up and taking down machine	
20 hr. drilling 575 ft. of hole.	
16 hr. tamping holes	
16 hr. miscellaneous	
84 hr. total at $0.745 per hour..	$62.58

Material

800 lb. Red H.B. at 10c.....	$80.00
150 No. 6 caps at 1.19c.....	1.70
16 electric delays at 8c.....	1.28
400 ft. copper wire.....	0.64
	$83.62
Total labor and material.....	$146.20

Recovered From Pillars (15-ft. seam)		
200x30x15 ft.	1,200 cars, say 1100 net	
$146.20 :1100	0.14 per car, demolishing	
	0.45 per car, loading	
	0.59 per car total	



Drill and tamping stick for driving long holes

Here the north-dip coal pitches evenly at 60 to 70 deg. Instead of the exceedingly long holes that Mr. Weisser had proposed, driven down the dip and passing through all the crossheadings, Mr. Miller used shorter holes about 48 ft. long driven up the dip from each of the crossheadings, but failing to pass from one crossheading to the one above by about 6 ft. The crossheadings were at 60-ft. centers and staggered from room to room. As they were about 6 ft. wide, the pillars between them were about 54 ft. long.

His breasts were at 54-ft. centers and 24 ft. wide, leaving 30x54-ft. pillars in between, though the pillar width sometimes varied. He drilled four 2½-in.-diameter holes if the pillars were 30 ft. wide and five if the pillars were much wider. The holes were started about 2½ ft. above the bottom rock in the crossheading and were drilled on a pitch 1 deg. greater than that of the average pitch of the seam. A bit was used with which, if necessary, the holes readily could be reamed to 3 in.

The holes were loaded with Permissible Red HB powder in 2x8-in. cartridges, made specially for this purpose. The cartridges were primed with an electric detonator in the next to the last cartridge at the lower end of the hole. To assure detonation of the entire charge in the hole, a No. 6 blasting cap was inserted in every fifth stick.

The outer holes at the end of each crossheading were primed with detonators which exploded more promptly than those nearer the center of the crossheading. Though the detonators are well timed, it is thought best to use only odd-number detonators, so that the difference in time at which they fire their several charges will assure that the outer shots will have disposed of their burden before the inner shots are called upon to dislodge theirs. Only a few delay intervals being necessary, Mr. Miller elected to have them somewhat wider than is provided in the regular scale.

Holes in every other third, or last, crossheading were short where these headings were staggered from breast to breast. Removal of the coal below the upper level was not desired, for this level probably was charged with rock and mud, which it was well to keep out of the mining. By the shooting the coal was immediately broken loose and fell to the bottom of the breast. The large shots used in this

method gave larger masses of coal than could be obtained by the shorter holes drilled with the ordinary method of shooting. Men had to go into the airway to break up lumps too large to pass the battery, and to throw aside timber which encumbered the chute and clogged the breast. Effort was made to load the coal from the pillar before top caved or bottom heaved.

When the long holes were being drilled, two holes were added in the down-pitch coal of the first crossheading, commencing 18 ft. up from the monkey, or air, heading and ending about 6 ft. from the center of that crossheading. These holes were shot at the same time as the others, and their shooting provided a means for the diversion of the coal from the pillar to the battery. Thus, the stumps at the mouth of the breast were nowhere less than 18 ft. thick, and their greatest up-pitch dimension was 36 to 54 ft., depending on the stagger, where provided, for one breast had its first crossheading 36 ft. clear of the airway and the next 54 ft. This left enough coal to protect the airway.

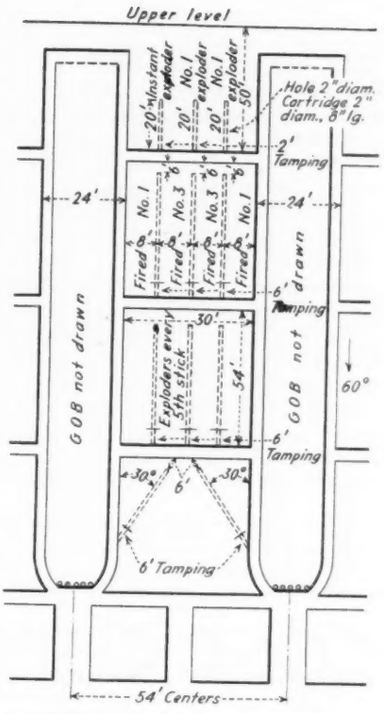
As the drillholes were set only 7 to 8 ft. apart, and they were 48 ft. long, care had to be taken in driving them. The first hole, if driven in the wrong direction, might make an unwelcome appearance in the side of the breast which it was supposed to parallel, might approach it so closely as to render the shot ineffective, or might recede from it so as to burden the shot with too thick a slice of coal. Interior shots might also converge or diverge, making the burden unequal.

To prevent this a plank was set across the mouth of the crossheading and, with aid of a string, placed and secured in the line taken by the breast above the heading. From this plank the direction of the drill was oriented at each hole and, after that was done, no difficulty in alignment was experienced, and each hole, in consequence, had an equal burden. It was found insufficient to align the drill by pointing it straight up the pitch; an error of 1 ft. in 6 too readily may be made, and even a smaller error is undesirable.

Seams in which pillars have been removed in the manner stated are the top split of the Mammoth, 15 ft. to 30 ft. thick; the Four-Foot, 10 ft. thick and, when worked, the bottom split of the Mammoth, 2½ to 3 ft. thick.

In this method of operation, no more bottom and top is mixed with the coal than with the ordinary method of shooting pillars. As the bottom is often soft at the Westwood colliery, it tends to lift and slide down the pitch. It is almost as much disposed to break and fall as the top, for, with a 70-deg. pitch, gravity does not hold it firmly in place. Should it be found necessary because of bad roof to shoot each unit of the pillar between main breasts separately, there is nothing in Mr. Miller's plan to make that difficult except that the top of the pillar below each crossheading would have to be shot so as to provide the required bevel toward the main breast by which it is to be extracted.

The old method with its continual firing of many small shots by miners



Long-hole method of removing pillar

standing on the edge of caving coal or beneath a treacherous face is extremely dangerous, whereas in the long-hole method the miners work in a safe place—a properly timbered crossheading—and in a solid block of coal where there is no movement. Fifty to one hundred small shots may be used in the old method, as against a single shot in the new, which brings down the entire pillar. Greater precautions can be taken when only one shot is to be fired and the miners, instead of going to the monkey level, which should not, but may, contain explosive gas, can go a distance down the main gangway to install their battery. The one shot with the long-hole method can be supervised by the mine foreman, a provision impossible with the many shots frequently used in demolishing a pillar. The discontinuous blasting of pillars, on the other hand, gives much opportunity for the roof to fall and bottom to lift and fill the batteries, which should receive coal only.

With the new method, the blasting time is so short that ventilation is not destroyed until after the shots have done their work. Shots usually are fired at the close of the day shift, and the fireboss or mine foreman makes a complete examination in and around the vicinity of the pillar to be fired, to see that no gas has accumulated. The entire circuit is tested with a galvanometer before

Westwood breaker

firing to assure that there are no faulty lines to cause shots to miss fire. The lead wires are taken down to the main gangway, where current is generated by a 50-hole plunger battery. After the shots in a pillar are fired, all return airways are carefully examined and a report of such examination is made to the proper authorities.

Equipment for drilling and tamping the holes consists of 200 ft. of ¾-in. air hose, weighing 115 lb.; Chicago Pneumatic rotary air motor, weighing 46 lb.; one 3-in. column, 4 ft. long with adjustable screw jack, weighing 62 lb.; one column clamp, weighing 12 lb.; one thread bar, 10 threads per inch with box attached, weighing 17 lb.; Howell drill gearing with Cyclone attachments, weighing 28 lb.; 50 ft. of 1¾-in. Cyclone splices in 2-ft. lengths, weighing 100 lb.; one Cyclone split bit with side reamer. Total weight of drilling outfit is 380 lb.

Forty-five feet of seasoned ash tamping sticks in 5-ft. lengths of 1-in. diameter are used for tamping the holes. The stick next to the powder has a 6-in. extension of wood of 2-in. diameter. The other sticks each have a male coupling on one end and a female on the other; such couplings are of copper or brass and so constructed that they cannot become disconnected in the hole yet so that they can be rapidly attached or disconnected when desired. The 48-ft. hole can be drilled at a speed of 30 ft. per hour after the machine has been securely positioned. A hole has been drilled with this machine up a pitch of 74 deg. for a distance of 104 ft. As a pillar may cost $1,200, its omission will save about $1,050 per chamber.

The Westwood mine was closed down for several months in 1936 when the Hazle Brook Coal Co. relinquished operation. It is now operated by Ralph W. Coho, of Lancaster, Pa., under the direction of Mr. Miller as superintendent. As soon as there are pillars to shoot, they again will be removed in the manner described.

COST CUT 17½ PER CENT

+ By Three-Year Mechanization Trial In Whitwell Low-Seam Mine

By CARL McFARLIN

President, Whitwell Smokeless Fuel Co. Whitwell, Tenn.

A REDUCTION of 17½ per cent in total production cost by mechanization has been proved at the Whitwell mine in the past three years by a series of experiments with various types of loading equipment operated on standard and modified mining systems. These experiments began shortly after the introduction of the 7-hour day on April 1, 1934, and the 17½ per cent reduction represents the saving it has been possible to make by mechanization to date as compared to total production cost with the hand-loading system under 1937-39 wage scales.

Preliminary investigations indicated that a more simple mechanization problem is presented in thick-seam operations with good roof and floor conditions. At the same time, however, thin coal and adverse mining conditions were shown to involve such high costs that it seemed probable that relatively small increases in

Fig. 1—Initial scraper-mining plan

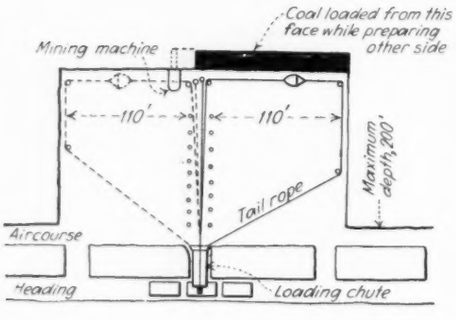
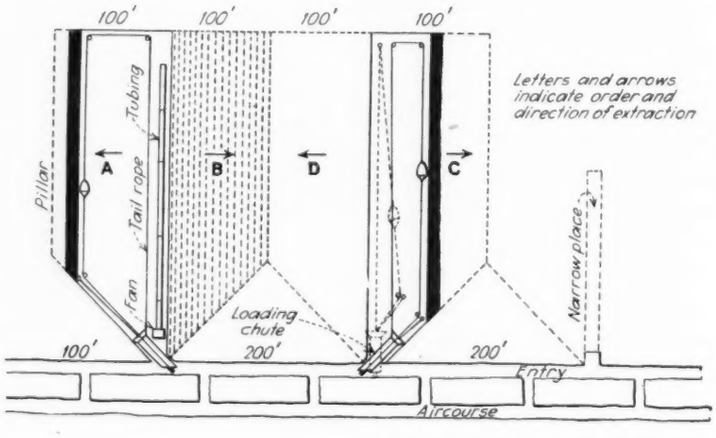


Fig. 2—V-system of scraper mining



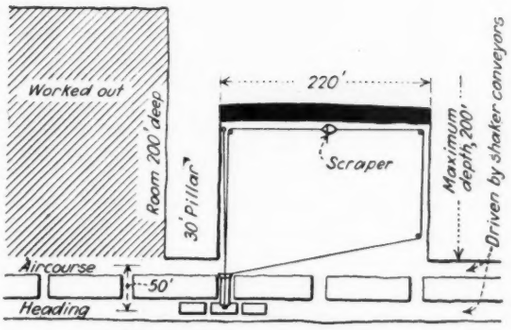


Fig. 3—Driving wide rooms with scraper loader

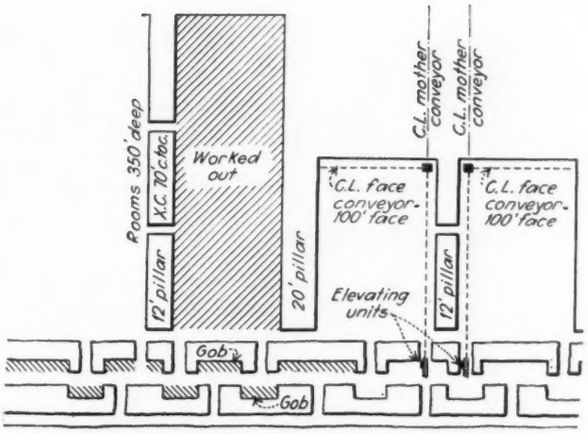


Fig. 4—Driving wide rooms with chain conveyors

output per employee would return percentage savings in total costs almost as great as in the higher-speed installations. In the light of these investigations, an experimental program was projected and equipment was purchased to prove actual cost savings before fully mechanizing. The following is a step-by-step outline of the methods used and the results obtained since starting on the mechanization program in 1934.

The Whitwell mine is located at Whitwell, Marion County, Tennessee, approximately 25 miles west of Chattanooga, and is opened in the Sewanee seam, which varies from 24 to 54 in. in height and has an average working thickness of 39 in. The pitch of the seam is fairly regular, with a 3 per cent maximum gradient against the loads. The coal is fairly soft with very little evidence of face cleats and cleavage planes.

Whitwell is quite an old mine, having been opened about 40 years ago by the Tennessee Coal, Iron & Railroad Co., which extracted almost all the coal near the old opening, at which point the present tipple is located. Mining is now carried on through the No. 6 opening, so called because it was the sixth made since the property commenced operation. This opening lies $1\frac{3}{4}$ miles to the north of the tipple.

Haulage is quite a problem with mine cars holding an average of 1 ton, a track gage of 26 in., an average underground haul of $1\frac{1}{4}$ miles and a $1\frac{3}{4}$-mile tram along the side of the mountain to the upper tipple, where cars are dumped into a 100-ton bin. Coal is drawn from the bin into 10-ton monitors for lowering down the mountain a distance of 1 mile to the tipple, where it is prepared for market, first by screening and then by washing the smaller sizes in Elmore jigs and over Deister-Overstrom "Diagonal-Deck" coal-washing tables.

Actual mechanization of the mine was commenced in 1934 with the installation of two scraper loaders. Considerable initial experimental work was done in connection with the operation of these machines, as the importance of keeping any mechanical-loading equipment in full operation with the small-sized mine cars greatly complicated the problem. Therefore, to simplify matters, a few 2-ton cars were purchased to serve each loader and they were routed in such manner as not to interfere with the normal operation of the property with the smaller cars. Some credit for cost reductions in all the experiments must be given to the larger-sized pit cars, as the smaller-capacity car could adequately serve mechanical loading systems only where trackage facilities allowed the loading of several cars on a trip at a central loading point.

Scraper-loader experiments have included three systems, as shown in Figs. 1, 2 and 3. Under the system shown in Fig. 1 it was found that changing the ropes, sheaves, jacks, scoops, etc., from one side to another required too much time and cut unduly into the available loading time. Forty-five minutes to an hour was required for the crew of nine men to make the necessary changes, and, in view of this handicap, the system was abandoned, although total production cost was reduced to about 95 per cent of the hand-loading figure in this first major experiment.

The system shown in Fig. 2 has not been entirely abandoned, but a number of changes have been made in its application. Employing a regular crew of nine men, consisting of two machinemen (cutter and helper), one driller and shotfirer, one timberman, three face men, one operator and one car trimmer, with two additional clean-up men on the second shift, when necessary, it was found that System 2 (Fig. 2) was objectionable because too much rock-brushing was required at the loading point, due to the angle at which the hoists have to be set, and because of the narrow work required to get these places started. However, this deadwork can now be done with very little additional cost by the use of shaker conveyors.

After the trials shown in Fig. 1 and 2, a 220-ft. advancing face was opened off an aircourse and carried to a depth of 200 ft., as shown in Fig. 3. The hoist and loading chute were set in a heading crosscut at right angles to the working face and a crew of nine day men, made up as in System 2, with two additional clean-up men on the off shift, was employed. An average of 90 per cent of the hand-loading cost was achieved.

During the first experimental stages it was found that scraper loaders could not be used successfully unless the roof was good enough to stand without breaking for a distance of at least 8 to 10 ft. from the face. As most sections of the mine did not have these favorable conditions, it was decided to purchase and install a chain-and-flight conveyor unit made up of a 300-ft. mother conveyor and two 100-ft. face conveyors, for use in sections of the mine where poor top requires close timbering. Fig. 4 shows how these chain-and-flight conveyors are employed, with a preparation crew of four men cutting, timbering, etc., and a loading crew of two car trimmers, two timber and face men and eight hand loaders, or

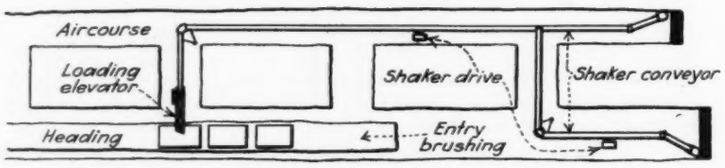


Fig. 5—Method of driving entries with shaker conveyors

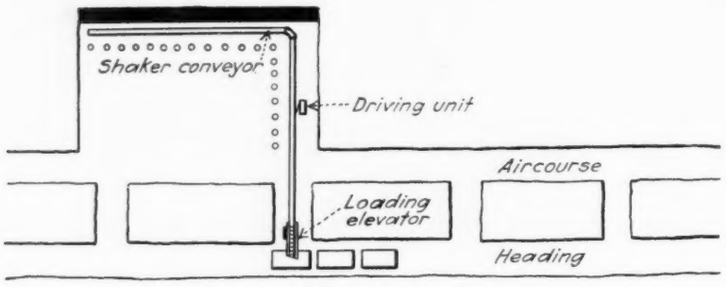


Fig. 6—Driving wide rooms with shaker conveyors

a total of sixteen men on the two 100-ft. faces.

The main disadvantage of the system shown in Fig. 4 is the high cost of moving the equipment, not only in making extensions from day to day but especially in moving from one set-up to another. However, it has its advantages in working out areas where the top is tender and resulted in a 10 per cent saving over hand methods, with a breakdown showing a marked increase in labor costs and a noticeable decrease in supply costs, as compared with the scraper-loading methods used up to that time.

After about a year's partially successful operation with the scraper and chain-conveyor units, wage rates were increased, further emphasizing the necessity for additional production per man employed. Consequently, it was decided to expand somewhat by the purchase of another type of mechanical equipment.

A more thorough study was made of the many problems involved and one more scraper loader and two shaker-conveyor units were added. The scraper loader was placed in that section of the mine where roof conditions were good and the shaker-conveyors were used exclusively in driving entries and in narrow development work for the scrapers.

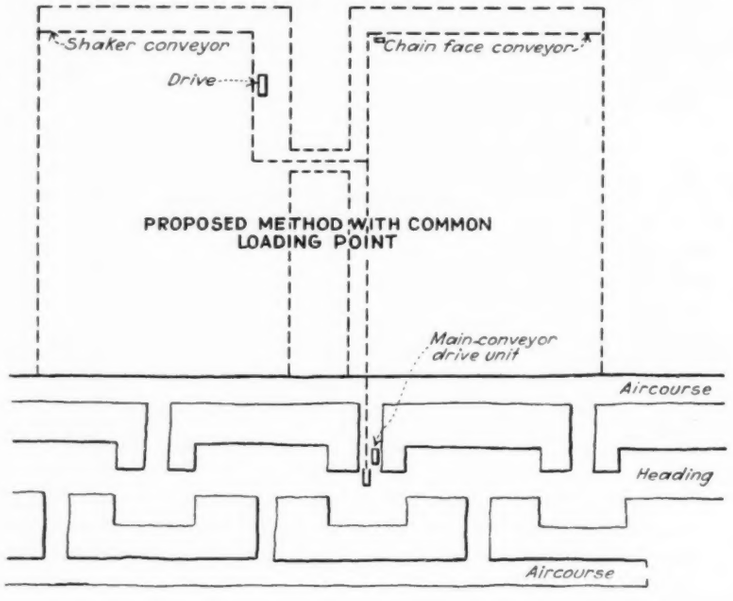
The application of shaker conveyors to entry development work is shown in Fig. 5. One shift leader, two cutter and loader operators, two cutter and loader helpers, and one car trimmer comprise the six-man crew for two units. A consistent average of two cuts per place per shift, or about 60 tons per shift for this crew, has been obtained in narrow work during the past year with cost reduction of 20 per cent of the hand-loading figure under the Oct. 1, 1935, scale. Top brushing the width of the roadway in the heading is carried on simultaneously with the advance of the coal faces in the heading and aircourse. Interference between coal production and bottom lifting is eliminated by bypassing the coal to the aircourse, leaving the rock crew free to shoot and gob or load the rock at will.

A further experiment involving loading all rock from brushing into mine cars with shakers, loading the latter either by hand or with the "duckbill," has proved to be the most economical way to handle this phase of the work, although it is not being followed to the exclusion of all other entry-driving methods to date. The problem of gobbing brushings also has been partially solved by driving a wide entry and using a short, light, portable belt conveyor of local design onto which the rock is hand-loaded directly from the shots. The conveyor sets at approximately right angles to the center line of the entry and discharges the brushings against the rib when the top is shot to provide height for the roadway.

Following the purchase of additional shaker units, long-face operations were commenced as shown in Fig. 6, with a crew of one cutter, one helper, three loaders and one car trimmer. This method resulted in a net cost reduction of 10 per cent of the hand-loading average under the Oct. 1, 1935, scale. However, the last proposed system of working two 100-ft. faces with a shaker unit on one and a chain conveyor on the other, both with a common loading point on the main heading (Fig. 7), has been in operation long enough to show a 17½ per cent net saving as compared with hand loading under the 1937-39 wage scales.

At the present time three scraper loaders, two complete chain-and-flight conveyors and six shaker conveyors are in use. Present scraper-loader practice (Fig. 3) has been proved the most efficient, as it calls for very little change from the old room-and-pillar system formerly in use except for an additional heading aircourse to provide adequate ventilation and to expedite the starting of new places. A cost averaging 82½ per cent of present hand-loading cost

Fig. 7—Latest working plan—driving two wide rooms with shaker and chain conveyors with common loading point



is being maintained with scrapers operating under good roof conditions. The present chain-and-shaker-conveyor method of long-face work under poor roof conditions also is averaging 82½ per cent of present hand-loading costs.

Entry-development work with shaker-conveyor units is averaging 80 per cent of present hand-loading cost, and the close coordination of all equipment with mine operating cycles will undoubtedly show continued improvement in all net cost savings here recorded.

SMALL STRIPPING UNITS

+ Provide Flexibility and High Output Under Siepman Working Plan

By IVAN A. GIVEN
Associate Editor, Coal Age

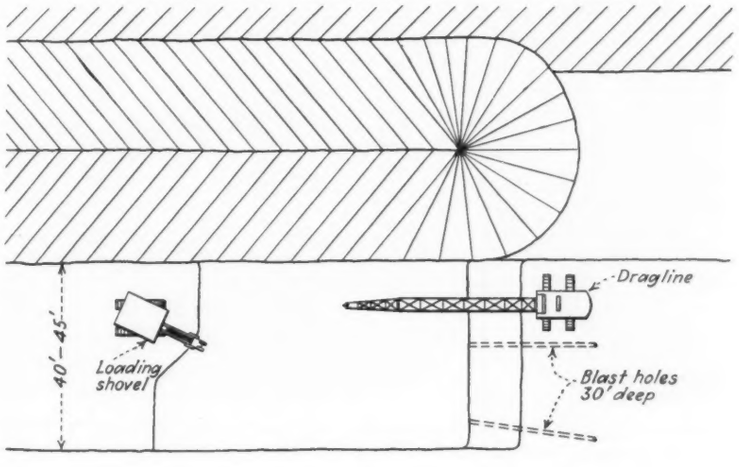
AMONG THE growing number of companies which have successfully applied small-capacity dragline and shovel equipment to the stripping of relatively large coal areas under average to heavy cover is the H. A. Siepman Coal Co., Coalmont, Ind. This company, which began operations on a 4-acre tract in 1933, now works five pits at three mines with an aggregate capacity of 2,500 tons per day, using 1¾- and 2½-cu.yd. draglines and ¾-, 1¼- and 1½-cu.yd. loading shovels. Seam thickness varies from 3 to 5 ft. and overburden thickness from 12 to 38 ft. Coal is hauled up to 4½ miles from the pits to the tipples in trucks. With the equipment in use, the company expects to strip up to 50 ft. of overburden. The smallest territory worked to date was the original 4-acre tract at the old White Edge mine. The largest territory, yet to be developed, comprises 600 acres.

Two pits make up the Ebony mine of the company in Sullivan County, Indiana, with the tipple (taken over from the old Baker-Dora Coal Co.) near Gilmore, on the Chicago, Milwaukee, St. Paul & Pacific R.R. The Indiana Sixth Vein, averaging 5 ft. in thickness, is mined, and the average output from both pits is 1,000 tons per day. Overburden thickness ranges from 12 to 38 ft., averaging 28 to 30 ft. Over the coal in No. 1 pit is 12 to 18 in. of slate, dark gray and hard in character, followed by 10 to 24 ft. of hard sandstone overlaid by clay and surface material. In No. 2 pit, however, the sandstone appears only occasionally, and when encountered is drilled with compressed-air equipment.

Stripping, loading and auxiliary equipment at Ebony includes one Model 95 Northwest dragline with 2½-cu.yd. bucket and 75-ft. boom; one Model 8 Northwest dragline with 1¾-cu.yd. bucket and 65-ft. boom; one Lorain 75B loading shovel with 1½-cu.yd. dipper; one 75A loading shovel with 1¼ cu.yd. dipper; one Keystone 6-in. blast-hole drill (not used at present); one Bissell horizontal overburden drill making a 4-in. hole; and certain other equipment, such as pumps, etc. Stripping units are equipped with Twin City oil engines; loaders with Waukesha gas engines.

Coal in both pits is dug without blasting, and the same applies to the overburden in No. 2 pit, with the exception noted above. In No. 1 pit, however, the hard sandstone stratum over the slate makes blasting a necessity. Stripping practice in this pit corresponds with that in all other pits operated by the company and is based on making a cut 40 to 45 ft. wide, as a rule, with or without blasting, as the case may be. In making the cut (Fig. 1) the dragline works from the bank in front of the overburden face, pulling the spoil up from behind and swinging 75 to 120 deg. to the dumping point. Where blasting is necessary, as in Ebony No. 1 pit, holes 30 ft. deep are put in as indicated in Fig. 1, using a horizontal drill. As a rule, only two holes are required, located approximately as shown. Occasionally, a third hole on the outside of the cut is necessary. These holes are loaded with Detonite, whereupon the dragline moves back and the blasts are

Fig. 1—Normal stripping plan at Siepman mines. Where the overburden can be dug without shooting the blast holes are omitted



fired. The dragline then moves up and resumes work until blasting again is necessary, whereupon the above process is repeated. Cleaning in the pit at this and other operations is based on hand-shoveling and the use of wire brooms.

Two pits also comprise the Clipper Block mine, producing an average of 800 tons per day. The tipple is located in the outskirts of Patricksburg, Ind., in Owen County, on the line of the Chicago, Indianapolis & Louisville R.R. The "Block No. 2" seam, averaging 3 ft. in thickness, is mined. Overburden varies from 17 to 32 ft., averaging 24 ft. Two stripping units corresponding to those at Ebony mine are employed. Loading is done with one 75A and one Northwest Model 105 shovels, both with 1¼-cu.yd. dippers. The coal is dug from the solid.

Stripping at Clipper Block No. 1 pit, where the coal is overlaid with a thin slate or shale stratum, with occasional sandstone areas, is done without shooting. In the No. 2 pit, however, the seam is overlaid by 8 to 16 ft. of gray slate. Consequently, it is drilled with a Macbeth horizontal drill making a 3½-in. hole and shot. The drilling plan corresponds with that at Ebony mine (Fig. 1). Also, the same general stripping plan is followed at both Clipper Block pits.

One pit 4½ miles east of the tipple at Coalmont, Clay County, comprises the Oak Leaf mine, with an average output of 700 tons per day. The Indiana Fifth Vein, with an average thickness of 4 ft., is mined, and shipments are made over the Chicago, Milwaukee & St. Paul. Overburden ranges from 16 to 26 ft. and averages 20 ft. Stripping is done by a Northwest-Murphy diesel dragline with a 75-ft. boom and a 2½-cu.yd. dipper. Coal is loaded by a Thew Type O gas shovel with ¾-cu.yd. dipper.

The coal at Oak Leaf is overlaid by a hard black slate ranging from 1 to 6 ft. in thickness. Because of its extremely hard nature, this slate must be shot before it can be dug. For this purpose, an Ingersoll-Rand compressor and pneumatic drill with I-R "Jack-Bits" are employed. The width of the pit and the general method of attack correspond to those of other operations of the company, with the exception that the loading shovel is used to help out the dragline in removing the slate. Under the stripping plan at this operation, the dragline, which works three shifts per day, removes the surface material and as much of the black slate as it can tear up without unduly delaying operations. Then, at the end of the loading shift, the loading shovel is moved up on the coal and the slate is drilled and shot, after which it is ripped up by the shovel and cast either into the spoil or over to a point where the dragline can pick it up.

Coal is loaded by small gasoline-powered shovels, such as this unit in Clipper Block No. 2 pit, which has caught up with the dragline at the end of the shift. Trucks turn in the pit behind the shovel

Where hard overburden is encountered, such as the sandstone in the Ebony No. 1 pit shown here, it usually is drilled with horizontal-type drills

Truck Coal to Tipples

Transportation of coal from the pits to the tipples at Siepman mines is done under contract by a Coalmont truck operator, using short-wheelbase Chevrolet and Ford end-dump trucks with a capacity of 5 to 5½ tons. The contractor's equipment, comprising sixteen units of this type, is sufficient to handle the usual tonnage produced and in addition, when all pits are being operated at capacity, extra trucks are hired from other contractors. Only one of the two pits at Clipper Block is worked on any particular day, and on this basis, full-capacity operation of all pits requires either 31 or 36 trucks, distributed as follows: Ebony, fourteen; Oak Leaf, ten; and Clipper Block, seven or twelve, depending upon which pit is working.

Distances from pit to tipple at the various operations are as follows: Ebony—No. 1 pit, 1¼ miles; No. 2, 2¼ miles; Clipper Block—No. 1 pit,

¾ mile; No. 2 pit, 4 miles; Oak Leaf, 4½ miles. The trucks as a rule operate over the county highways, and the company follows a regular program of keeping them in condition for all weathers, including surfacing with gob, fine coal or cinders and regular maintenance with graders and drags, usually every day. Trucks normally enter a pit at one end or the other by means of a runway cut down through the overburden and turn behind the loading shovel. In some cases, plank roads on wooden sleepers are laid in the pit where the bottom is soft by reason of the presence of moisture or for other causes.

Coal from the three Siepman operations is sold under the "Ebony Mine," "Clipper Block" and "Oak Leaf" trademarks by the Republic Coal & Coke Co., Chicago ("Ebony Mine" only), and the Zimmerman Coal Co., Terre Haute. "Clipper Block," primarily a domestic coal, goes into local markets, the Northwest and the Southwest. "Ebony" and "Oak Leaf" domestic sizes move mostly into Illinois, Iowa and Wisconsin, with steam grades going to railroad consumers and to steam users in the Northwest.

Ebony mine is equipped with a four-track wood-and-steel tipple equipped to hand-pick, screen and load, as a rule, 1½-in. screenings, 1½x4-in. nut, 4x6-in. egg and 6-in. lump. Occasionally, by changing screens, 4x8- or 1½x8-in. sizes are produced, with an 8-in. lump. Since the tipple was taken over from the Baker-Dora Coal Co., slack and nut booms have been added to permit loading all sizes over boom equipment, and a Jeffrey vibrator has been installed to remove $\frac{3}{16}$-in. fines from screenings to make a stoker coal.

The Clipper Block tipple, also of the four-track type, is equipped to ship as a rule 2-in. screenings; 2x4-, 2x6- or 2x8-in. nut or egg; 4x6- or 4x8-in. egg; and 6- or 8-in. lump. Lowering chutes are provided for loading all sizes, and in view of the fact that most of the coal goes into the domestic trade the Viking hot-oil-vapor process has been installed for dustproofing all sizes. Primary sizes normally made in the Oak Leaf tipple are: 1½- or 2-in. screenings, 1½x4- or 2x4-in. nut, 4x6-in. egg and 6-in. lump, all chute loaded.

At the Oak Leaf pit, the hard black slate over the coal is drilled with pneumatic equipment and then dug by the loading shovel, which casts either into the spoil or moves the slate up to where the dragline can reach it

REGENERATIVE INCLINE

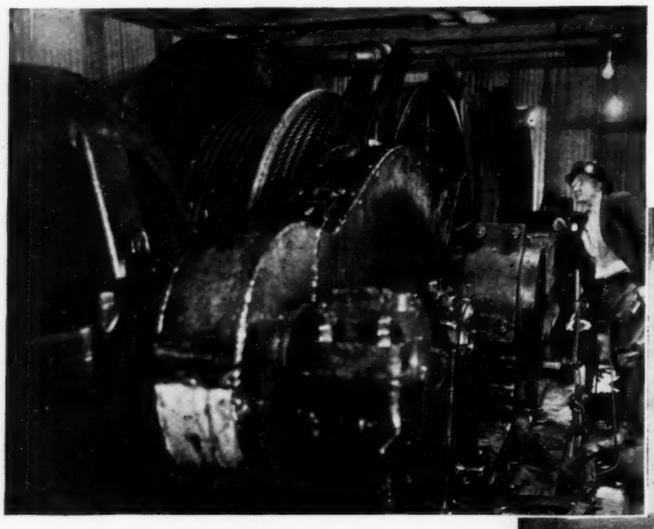
+ Handles Men, Coal and Supplies

At New Gauley Mountain Mine

By J. H. EDWARDS
Associate Editor, Coal Age

SETTING UP the engineering goal of improvements in all design details to eliminate or reduce as far as possible the several difficulties experienced with an earlier installation has resulted in a combination monitor and supply hoist plane with new and efficient features at the Jodie (W. Va.) operation of the Gauley Mountain Coal Co. A motor-driven incline machine provides for using the monitor tracks, ropes and control equipment for hoisting men and supplies and affords as a secondary advantage regenerative braking of the loaded monitors in their descent from an elevation 1,000 ft. higher than the tipple.

This incline serves a new 100-ton-per-hour mine—Rich Creek No. 2 Splint—opened last year to replace the old Rich Creek No. 2 Coalburg mine, which was opened on the opposite side of the valley and delivered by monitor to the present tipple. Additional screening and loading facilities were added to the plant to prepare a wider range of sizes. New dump bin, feeder, in-

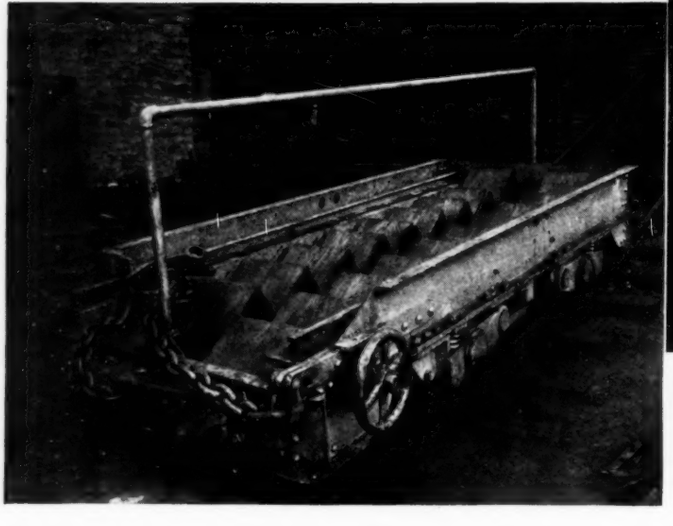


Monitors are controlled by this heavy-duty traction hoist geared to a 200-hp. induction motor. At right, G. E. Hoover, chief engineer, notes the changed position of the slip-ring rope grooves on the spider.

Regenerative braking relieves the operator of having to use his judgment in limiting speed.

A straight track, 1¼-in. rope and practically balanced operation, give this man-hoisting incline a high safety rating.

The left-hand monitor track extends down to the supply house and is used for hoisting men and materials.



Made from the chassis of a discarded battery locomotive, this incline car accommodates 20 men and has rails at each side of the steps to carry truck-mounted machines.

spection room and steel-truss-supported 36-in. belt conveyor from dump bin to tipple were furnished by the Kanawha Manufacturing Co.

At the old mine, where an incline machine with manual brake and without motor was used to control the monitors, the rope life was highly unsatisfactory due to the unequal groove wear of the solid multiple-grooved traction sheaves and also the shocks from the uneven manual braking. A separate incline, used for handling men and supplies, was expensive to maintain and carried but ten men. Rough handling of the coal due to the typical end-loading of the monitors and lack of automatic speed regulation further condemned the arrangement. All of these objections were overcome in the new installation, on the opposite side of the valley.

Slope About Half Mile Long

To utilize the monitor incline, which is 2,450 ft. long and has an average pitch of about 24 deg., for hoisting mine equipment on its own wheels, the incline track gage was made the same as that of the mine, or 44 in. To afford safety in using the same incline for man hoisting it was double-tracked (four rails) for its entire length. Rails of 60-lb. weight are set on 6x9-in. 7-ft. white oak ties except that every tenth tie is 15 ft. long and extends across both tracks.

The south track (left-hand when looking up the incline), on which men and supplies are hoisted, is continued in practically a straight line down beyond the monitor dump bin into the yard between the power plant and supply house and the valley floor.

The center line of the dump bin, which is entered by a three-rail double track, makes an angle of 14 deg. 15 min. with that of the incline. Therefore the right-hand track has a slight curve at the bin approach and the left-hand track includes a No. 4 switch. For safety reasons, the waiting room and loading point for the men is located above the switch. This avoids the steep section of track alongside the bin, obviates crossing the highway at the foot of the incline and keeps the man car on unbroken track. Two rails of the incline are bonded with arc-welded No. 4/0 copper bonds and thus serve as the return for the 600-volt d.c. circuit from the power house to the mine level.

At the top of the incline the man-station platform is below the loading chute and from this platform stairs lead to the headhouse level, 18 ft. above. The monitor tracks extend under the headhouse and on back up the hill 150 ft. to accommodate a switchback leading to the mine yard.

The cylinder-shaped monitors are loaded through a hinged chute which directs the flow against the curving side, thus causing the coal to take a flat spiral path to the front end. This limits the speed of flow to a rate considerably lower than if the coal was end-loaded directly onto the bottom.

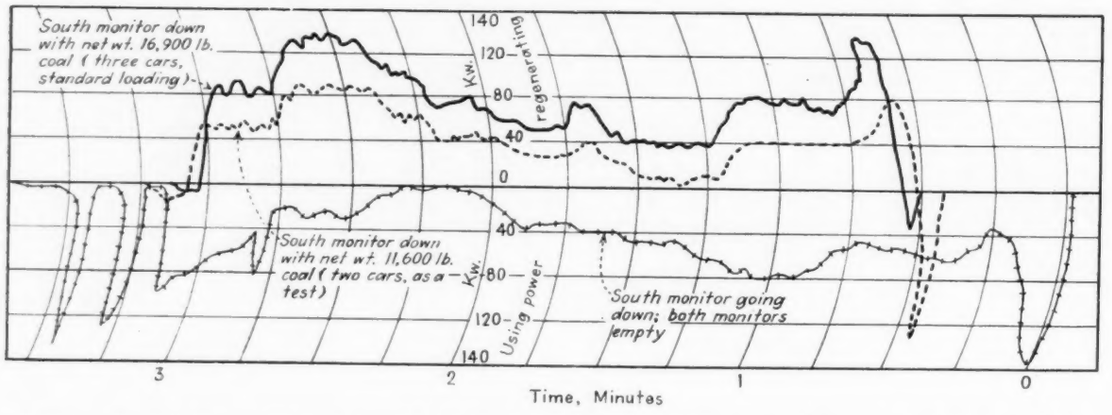
Weight of a monitor is 4 tons and the load consists of the contents of three mine cars, or 8 tons average and 9 tons maximum. Construction features include 24-in.-diameter Meehanite cast wheels pressed onto 4-in. axles, a wheelbase of 72 in. and locomotive-type journal boxes with spring and equalizer mountings. Plow-steel 1¼-in. 6x19 preformed Lang-lay rope is used and the rope speed is 800 ft. per minute.

The traction-type double-sheave hoist, locally termed the incline machine, is a Lidgerwood unit with cast-steel gears and two sheaves, six and seven grooves, mounted in tandem with shafts horizontal. Rope grooves are in individual 72-in. steel rings mounted (snug slip fit) on cast-iron spiders. These rings, which are lubricated, creep relative to each other as much as 12 in. during the hoisting cycle, thus maintaining a uniform tension in the six wraps of the rope. Although built in 1910 and used many years in another industry, this hoist is in excellent condition.

Geared to the sheaves with a ratio calculated to give 800 f.p.m. rope speed at synchronism, is a 200-hp. 600-r.p.m. 2,300-volt General Electric wound-rotor induction motor with contactor primary and manual-drum secondary control. A series of operating tests with a graphic meter indicated that with the average loading of 8 tons (net) the power regenerated to the line averages 80 kw. for 2½ minutes and amounts to a recovery of 0.42 kw.-hr. per ton. Although this power aggregates in value ½c. per ton, the more important advantages lie in speed control and frictionless braking.

Side loading of the monitors and absence of a bin reduce degradation. In the descent of 1,000 ft. and travel of 2,450 ft. the monitor load regenerates 80 kw. for 2½ minutes

Control equipment is devoid of relays and speed devices which could be used for effecting or indicating exact electrical operation when lowering coal. The operator, stationed in a spacious room in the headhouse above the loading chute, where he has an unobstructed view of the whole incline, energizes the primary contactors and then brings the secondary controller to full speed at a rate of advance coinciding with the natural acceleration in monitor speed resulting from the loaded monitor overbalancing the empty; he leaves the controller in that position (rotor resistance short-circuited) until he shuts off the motor and applies the hand brake at the end of the run. A solenoid brake on the motor shaft is arranged with a manual trip for

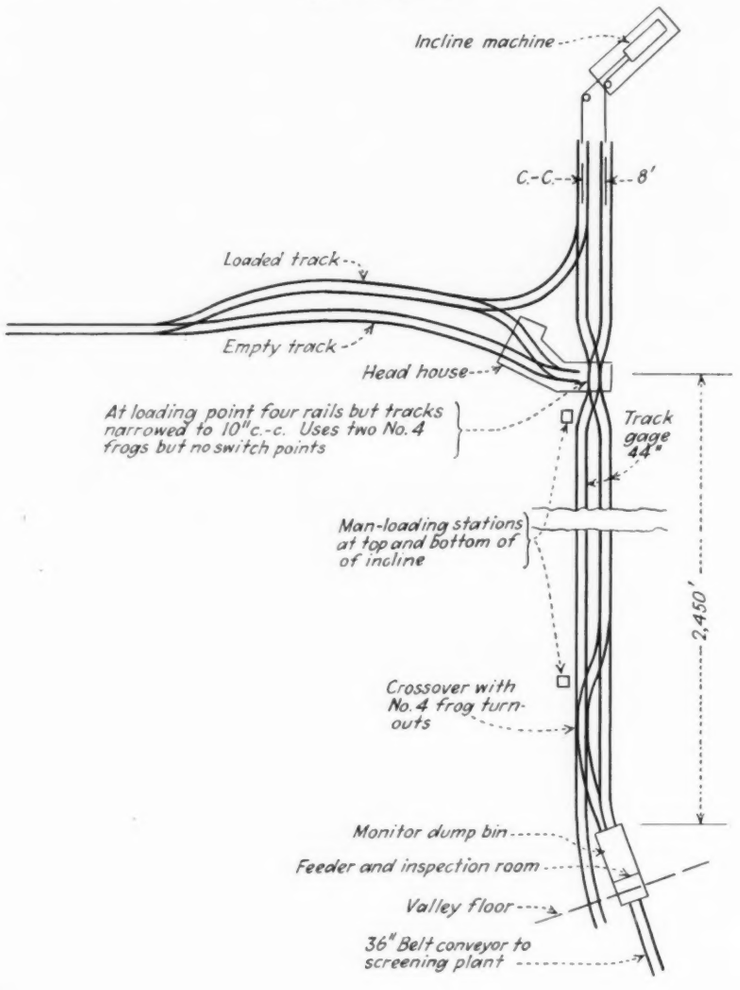


Sections of a graphic wattmeter chart made during a series of tests are here superimposed to show comparisons at different loadings

use only in case of an emergency.

To adapt the incline to hoisting men the south monitor is parked in the valley and its rope is coupled to a special man car. This was built in the mine shop; the Timken-equipped trucks, bumper hitchings, brake rigging and a part of the frame of a dismantled battery locomotive were used in its construction. The brake is used only in the yard at the power plant, where the truck is parked on a slight grade. Two rows of wooden steps on the truck deck, with a handrail between, accommodate twenty men in a standing position and the State mining department has approved the hoisting equipment for that number. Men are hoisted and lowered, using the incline machine as a power-consuming hoist, with the controller at full-speed position. Overbalancing of the loaded man truck by the empty monitor is not sufficient to cause regeneration even during hoisting. The car would soon stop and stand still in case the power failed and the hoist operator did not set the hoist brake immediately.

The track layout accommodates man and supply hoisting on the south (left-hand) side


Incline machine
C.-C.
8'
Loaded track
Empty track
Head house
At loading point four rails but tracks narrowed to 10" c.-c. Uses two No. 4 frogs but no switch points
Track gage 44"
Man-loading stations at top and bottom of of incline
2,450'
Crossover with No. 4 frog turn-outs
Monitor dump bin
Feeder and inspection room
Valley floor
36" Belt conveyor to screening plant

Rails Set on Man Car

Track rails, on a 44-in. gage mounted on top of the man car, provide a means of carrying mining machines while on their trucks, as well as other low-clearance equipment. The alternative of hoisting the low-clearance equipment with wheels direct on the monitor track necessitates the removal of the rope idlers. This is not necessary for the hoisting of mine cars, which are used for carrying timber and other bulky mine supplies. For this hoisting the mine cars are hitched back of the man car and men are not then allowed to ride. As many as three mine cars back of the man car can be cleared at the top switchback. When at that position the counterbalancing north monitor has run through a cross-over just above the monitor dump bin and is standing in the valley. Equalizers on the monitor trucks and also on their rope hitchings impart flexibility necessary for running through switches and around curves.

Cars and other equipment used in

the new mine were transferred from the worked-out Rich Creek No. 2 Coalburg mine. The cars have wooden bodies with lift endgates and are tipped in a horn dump over a hopper with a one-car capacity. The hopper and its hinged chute function as a cut-off gate in loading the monitors. The mode of operation is to dump one carload against the raised chute and then two more cars directly into the monitor after the latter has been spotted and the chute dropped to loading position.

Coal thickness in the Rich Creek No. 2 Splint mine is 4 ft. Hand loading, room-and-pillar work, and track haulage from room face to headhouse are the practice thus far. The simplicity and directness of the incline layout indicate careful engineering and the smoothness of operation is a promise of low operating cost and safety.

ARC-WELD BONDING

+ Requires Proper Choice of Bond And Care in Application

By C. R. KINGSBURY
Engineer, Transportation Department

and F. F. SMITH
Engineering Secretary
Ohio Brass Co.

THE NECESSITY for a complete circuit—generator or rectifier, feeder, trolley, motor and *return*—properly balanced as to design and construction is recognized by engineers as essential for electric haulage, just as for any other electric circuit. Resistance in the return circuit—the track—is just as fatal to the over-all efficiency of the haulage system as a poor supply or incorrect overhead capacity.

If joint bars, alone, were required to carry electric current, an extremely unstable and unsatisfactory distribution system would result. Constantly varying resistances—electrical gaps—which make it impossible to operate the system, and harmful conditions of electrolysis are brought about. Thus it is highly important that rail joints be adequately bonded to insure haulage efficiency.

The next step in the consideration of the problem is to choose the proper bond. Selection of a bond not properly fitted to carry the current around these joints is a fruitful source of lost power. Three factors enter into the power loss and current-carrying capacity of a rail bond: its cross-section, its length and its metallic analysis. In most cases, the bond length is determined by the length of the angle bars to be spanned. With

Fig. 1—Equivalent section in copper of different weights of rail for various ratios of the resistance of the rail to that of the copper

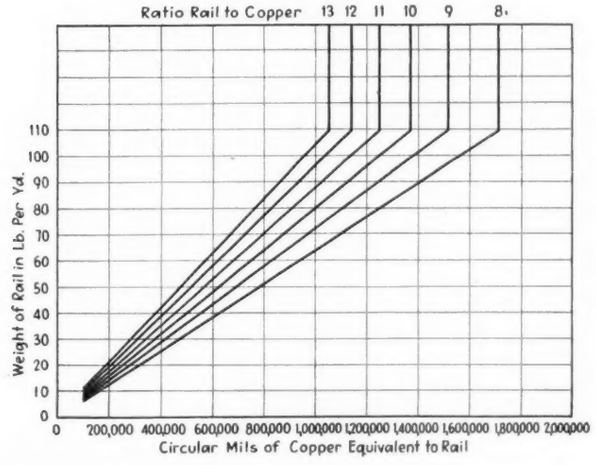
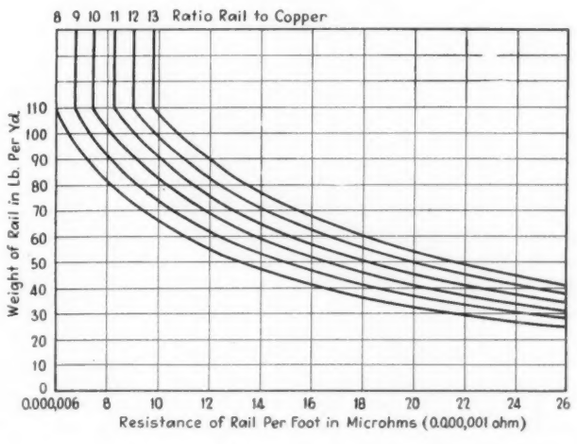


Fig. 2—Resistance of a 1-ft. length of rail in microhms for different weights of rail and ratios of rail to copper


8 9 10 11 12 13 Ratio Rail to Copper
Weight of Rail in Lb. Per Yd.
0 10 20 30 40 50 60 70 80 90 100 110
0.000,006 8 10 12 14 16 18 20 22 24 26
Resistance of Rail Per Foot in Microhms (0.000,001 ohm)

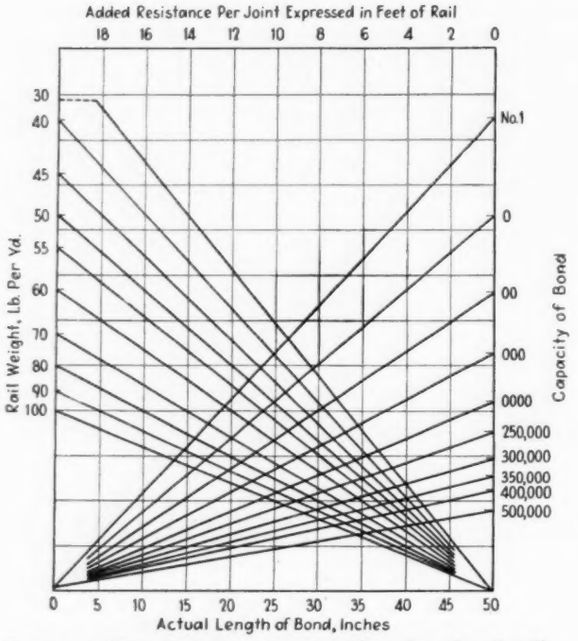
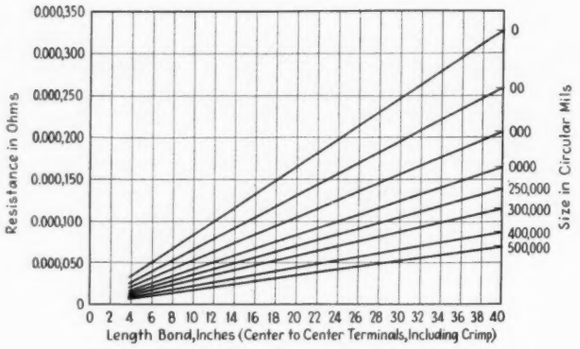

Added Resistance Per Joint Expressed in Feet of Rail
18 16 14 12 10 8 6 4 2 0
Rail Weight, Lb. Per Yd.
30 40 45 50 55 60 70 80 90 100
Capacity of Bond
No.1 0 00 000 0000 250,000 300,000 350,000 400,000 500,000
0 5 10 15 20 25 30 35 40 45 50
Actual Length of Bond, Inches

Fig. 3—Added resistance, in equivalent length of rail, for various capacities and lengths of bonds and weights of rail (bonds in best condition)



Approximate Safe Current-Carrying Capacities of Rail Bonds.
These Values Should Be Doubled for Track Return (Both Rails Being Bonded)

	7" to 12": Basis, 1 Amp. per 200 C.M.	12" to 36": Basis, 1 Amp. per 300 C.M.	36" and longer: Basis, 1 Amp. per 400 C.M.
2/o bond	665	445	333
4/o bond	1058	700	530
300,000 C.M.	1500	1000	750
500,000 C.M.	2500	1,666	1,250

Fig. 4—Resistance of different capacities and lengths of rail bonds. Length is the unformed length between centers of bond terminals

◆

this in mind it can be seen that the major problem in bond selection is cross-section. In determining this cross-section, Kelvin's law of electrical economy ordinarily is used. This law reads: "The most economical section of a conductor is that which makes the annual cost of power losses equal to the annual interest on the capital cost of the conductor material plus the necessary annual allowance for depreciation." Therefore, the obvious thing to do is to select a size of conductor which will have the minimum of voltage loss consistent with economical principles of transmission. It is just as easy to "overbond" as it is to "underbond." Half way between the two extremes lies the proper and economical degree of bonding.

Most rails have far more conductivity than they need for current requirements. Making the bond of the same copper-equivalent conductivity as the rail would be extravagant in the majority of cases. Copper-equivalent values are given in Fig. 1. Actual procedure in the calculation of bond size for certain conditions is carried through on a trial and error basis. Certain assumptions must be made and subsequently altered to obtain an accurately indicative result. The usual sizes available are 2/0 and 4/0, 250,000, 300,000, 350,000, 400,000 and 500,000 circ.mil, the most common size being the 4/0.

As an example, let us assume that it is desired to determine the proper capacity bond to use on a 90-lb. track, 10,000 ft. in length, carrying a load of 300 amp. It is decided that a voltage loss of from 10 to 20 per cent will be acceptable. Taking advantage of past experience, it reasonably could be estimated that a copper-strand 4/0 bond, 42 in. in length, will give economical service. Whether this is correct can be determined by using the following formula to simplify calculations:

$$e = \frac{IRL}{2}\left(1 + \frac{L'}{d}\right)$$

where: R = resistance per foot of rail (Fig. 2)
L = length of track in feet
d = distance between joints
L′ = length of rail whose resistance is equivalent to that of the bonded joint (Fig. 3)
I = load in amperes
E = line voltage
e = voltage drop

Substituting these values it is found that:

e = 16.65 (1 + 0.533) or
e = 25.5 volts in 10,000 ft.

If it is assumed that the initial voltage is 250, then the voltage loss is 10.2 per cent. From this it may be assumed that the bond selection is fairly correct. Here again there is the question of varying conditions and the application of Kelvin's law to the final result.

In making a decision as to where and when additional bonding is needed, a thorough picture of future mining operations should be at hand. Each case should be considered individually, both from the voltage-drop and power-savings standpoints. Suppose a given section of a mine is to be worked out in a year or less, and the present rail bonds have a capacity of less than the present load, thus resulting in a large yearly power loss. If this mine section were rebonded with the proper capacity bonds and the total cost of this rehabilitation were greater than the cost of the power saved, it would not be wise to install new bonds. On the other hand, if the cost of motor repairs was high due to heavy currents caused by extremely low voltages at the working face, the expenditure for new bonds would be well justified.

Briefly, the proper application of welded-type rail bonds in mines involves the selection of a bond of correct type and capacity, cleaning the rail surface thoroughly and securing a weld with good penetration. Welded-type bonds are designed for four methods of application: steel arc welding, copper-alloy arc welding, gas welding and carbon arc welding.

Steel arc-weld bonds have a steel terminal and are applied with a soft-steel arc-welding rod making a "steel-to-steel" weld. Because the metal is the same in the rail, welding rod and bond terminal, the results are more nearly uniform than with any other type of bond, and these bonds can be applied with less difficulty. Less voltage is required

for applying a steel weld bond than a copper-alloy weld bond, making it possible to secure better results with fluctuating voltages and to continue bond applications even when sharp drops in voltage occur on the line. For these reasons the steel terminal bond is most commonly used.

Copper-alloy arc-weld bonds are applied with a copper-alloy arc-welding rod and also are used quite widely, since they provide a full copper path from rail to rail. A peculiarity of copper which has an important bearing on its use for rail bonding is its strong affinity for oxygen when in the molten state. A large part of the difficulty in casting copper or welding it by any fusion method is directly chargeable to this disposition to become highly oxidized when heated to the fusion point. This tendency is overcome by using a welding rod which contains the correct amount of deoxidizing elements. Thus it is possible to obtain homogeneous and ductile welds of good density and high strength with little tendency toward oxidation.

Bonds for application by the gas-weld process have either a steel or copper terminal. A copper-alloy rod of carefully developed analysis and control for oxyacetylene welding is used for this type of bond. It produces a dense ductile weld of high electrical conductivity and with a deposit of practically pure copper.

Clean Rail Before Bonding

After selecting the proper bonds the effectiveness of the application depends largely on using the correct welding rod with the correct current on a clean rail surface. Before attempting to weld a bond on a rail the rail itself should be thoroughly cleaned. If it has a particularly heavy rust scale, this deposit should be removed with a cold chisel, after which the surface should be thoroughly cleaned with a wire brush. In some instances there is a heavy coating of grease on the rail. This coating should be completely removed.

Depending on the type of bond selected—that is, whether it is a steel arc-weld or a copper-alloy arc-weld unit—there is a definite current to be used. The current also depends on the size of welding rod used. For a 5/32-in. steel rod a current of from 120 to 130 amp. should be used, while for a 3/16-in. steel rod the current should be approximately 150 amp. This current requirement is governed somewhat by the type of welder, whether of the resistance or dynamotor type. Lower current values should be used with the resistance-type welder. An arc approximately $\frac{1}{8}$ in. long gives the best results. A longer arc tends to deposit burned metal and will not give a smooth, even bead. There also is more waste of welding rod with a long arc.

A better bonding condition is obtained on any given joint if the bond terminal farthest from the nearest feeder or substation is welded first (Fig. 5 illustrates the right and wrong way to weld a bond). This means that the welding arc is first between the rod and the rail, giving a greater penetration into the rail with only a slight attachment to the bond terminal. The first bead around or across the terminal should be in the corner between the bond terminal and the rail, mainly on the rail. The second bead should be placed on top of the first one, attaching it to the bond terminal. The third bead should be placed so that it connects the first and second beads with the rail, giving a smooth finish to the weld.

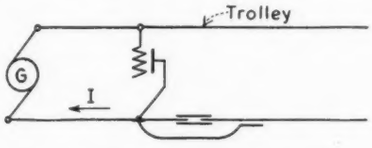


Fig. 5—Wrong welding procedure

Welding of the terminal nearest the source of power first forces the greatest portion of the welding current through the bond on its return to the generator.

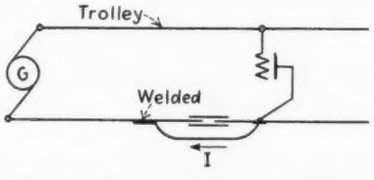


Fig. 6—Wrong welding procedure

The bond nearest the source of power was first welded in this schematic diagram. Notice how the welding current, *I*, due to the resistance of the rail point, flows through the bond, which offers a low-resistance path. This sequence will result in a poor, unsolid weld on the last bond terminal.

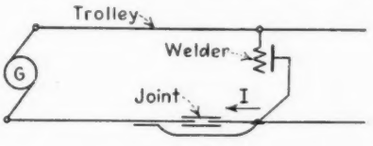


Fig. 7—Correct welding procedure

This drawing shows the correct sequence in welding rail bonds. Notice how the current is forced through the joint plates and not through the bond. With the current returning through the rail joint there is an equal penetration and even distribution of the welding metal on both the rail and the bond terminal.

For copper-alloy arc-welding such conditions as clean rail, proper rod and proper welding currents also are necessary. When using copper rod as an electrode it always should be positive, whereas for steel arc-welding best results are obtained with the electrode negative. With a 5/32-in. copper rod 180 to 200 amp. should be used, while with a 3/16-in. rod the current should be approximately 200 to 220 amp. Here again the resistance welder requires the lower current values. The arc length should be maintained at approximately $\frac{1}{4}$ in.

Copper alloy arc-welding requires a retainer of some sort to hold the fused metal. In most cases the bond is provided with a terminal which forms a complete mold when placed against the rail. The bond terminal must be fastened to the rail with a clamp which will hold the terminal tightly against the rail and prevent any molten metal from escaping.

Arc-Welding Bond to Rail

With the bond in position on the rail base, the arc should be started between the electrode and the rail at the opening provided in the terminal. The arc will immediately fuse the rail surface and the deposited metal forms a thorough union with the rail. The terminal is filled up with metal deposited from the electrode and the arc should be applied from time to time directly to the ends of the copper strands, and a deposit made thereon of the electrode metal. This assures a complete mechanical and electrical connection of the stranded copper cable, terminal and rail with each other, through the medium of the fused electrode. As the weld is finished, attention should be given to completely filling up the terminal over the point where the copper strands project through the terminal sleeve, also to careful manipulation of the arc so as not to permit the fused metal to run away. In the case of bonds applied to the ball of the rail the terminal should be tapered up onto the rail, forming a sloping surface to deflect side blows.

Use of the carbon arc for welding bonds necessitates a mold. The rail surface in this case must be cleaned as above, the mold placed around the bond terminal, the arc drawn between the rail and the carbon electrode, and the rod fed in to the arc thus established. The arc length in this case may be slightly greater than when using copper-alloy rod as the electrode. Aside from this difference, the procedure is the same as for copper arc-welding.

WHEN TO REPLACE IMPELLER

+ To Obtain Optimum Combination Of Pump Power and Repair Costs

By HECTOR B. SAMSON
Scranton, Pa.

AS MINING progresses, the problem of dewatering underground workings becomes increasingly important because of the large quantity of water to be handled and the consequent increased cost of pumping. This must be apparent when one considers that at some mines the weight of water pumped is from ten to fifteen times the weight of coal mined. Clearly, then, economical pumping is a step toward low coal-production cost.

Pumping cost can be roughly broken down into four parts:

1. Fixed charges in equipment
2. Attendance
3. Power cost
4. Repairs and maintenance.

The first of these items, the fixed charge, is determined primarily by the purchase price and usually is not materially affected by the amount or method of operation. That is to say, once the equipment is purchased and installed, little can be done about the fixed charges. Attendance cost per year usually is fairly constant, particularly in the larger and more important pumping stations. The problem of pumping-cost reduction, after a station is installed, then lies in obtaining a correct balance between power cost and the cost of repairs. It is erroneously supposed by some engineers that the minimum total cost is obtained when the power cost equals the repair cost. While this may be true in special cases, it is not difficult to show mathematically that it is not true generally.

It is common knowledge, easily verifiable by simple tests, that the longer a pump operates the more it wears, and that this wear is evidenced by decreases in both capacity in gallons per minute and power input in kilowatts. These two quantities usually fall off in such a way that the energy consumption in kilowatt-hours per gallon pumped becomes larger, with a consequent rise in power cost per gallon pumped. If no repairs are made, the repair cost will be zero, but the pump will get into such bad condition that it will not pump water. The power input, however, will not drop to zero but instead will fall to a value determined by requirements for churning the rotating parts of the pump, supplying motor losses, etc. Obviously, power cost per gallon will approach infinity, and to prevent this exorbitant increase the pump should be repaired and its good operating condition restored.

When to Replace Impeller

If, on the other hand, the pump is repaired by putting in a new rotating element every day, it always will be in first class condition and the power cost will be at a minimum, but the repair cost will be excessive. Since either extreme is, of course, ridiculous, the problem that immediately arises is, how often should a new rotating element be installed so that the sum of the power cost per gallon pumped and the repair cost per gallon pumped is a minimum? The answer to the problem may be determined in a number of ways. The method outlined below, however, while perhaps not the most direct, is selected because it does not mask the physical picture behind a screen of mathematics. The data used in the following example are entirely arbitrary and do not represent any particular station.

The first step is to obtain data to fill out Table I, either from the routine operating log or, in the absence of permanent station instruments, from systematic testing. The first column in the table gives the number of hours the pump has operated since the last renewal and provides a measure of the life of a rotating element. Columns II and III show, respectively, how capacity and power input fall off as the pump wears. Since the material in Table I are observed items, it is well to plot Fig. 1 as a means of fairing the data. Most measurements have an irritating habit of being slightly in error, so that some method of averaging is necessary to obtain a representative picture. In this case, a judiciously drawn curve is satisfactory.

Table I—Pump Operating Data

Hours Operated Since Last Renewal	Gallons per Minute	Motor Input, Kilowatts
(I)	(II)	(III)
0	2500	312
200	2300	305
400	2100	298
600	1900	292
800	1700	285
1000	1500	278
1200	1300	271

These data now are transformed into costs as shown in Table II. Column I (hours since last renewal) is the same as Column I of Table I. Column II gives the total gallons (in thousands) pumped up to the corresponding time in Column I. For example, at $T = 0$, G.P.M. $= 2{,}500$, and at $T = 200$, G.P.M. $= 2{,}300$, so

Table II—Pump Operating Cost

Time, Hours (I)	Thousands of Gallons Pumped (II)	Kilowatt-Hours (III)	Power Cost — Total (IV)	Power Cost — Cents per 1,000 G.P.M. (V)	Distributed Impeller Replacement Cost, Cents per 1,000 Gal. (VI)	Total Cost, Cents Per 1,000 Gal. (VII)
0	0	0	0	....	....	....
200	28,800	61,720	$ 617.20	2.14	0.87	3.01
400	55,200	122,080	1,220.80	2.21	0.45	2.66
600	79,200	181,080	1,810.80	2.29	0.32	2.61
800	100,800	238,720	2,387.20	2.37	0.25	2.62
1,000	120,000	295,000	2,950.00	2.46	0.21	2.67
1,200	136,800	349,920	3,499.20	2.56	0.18	2.74

that the gallons pumped in the interval are:

$$\frac{2{,}500 + 2{,}300}{2} \times 60 \times 200 = 28{,}800{,}000$$

For the interval 200 to 400 hours

$$\frac{2{,}300 + 2{,}100}{2} \times 60 \times 200 = 26{,}400{,}000.$$

To the latter must be added the 28,800,000 gal. already pumped, or 28,800,000 + 26,400,000 = 55,200,000 gal. Column III (kilowatt-hours) is filled out in a similar manner. Column IV gives the power cost and is obtained by multiplying the consumption by the cost per kilowatt-hour. Column V (Column IV divided by Column II) gives the power cost in cents per thousand gallons pumped.

Column VI gives the repair cost per thousand gallons pumped. Here it is assumed that, based on past records, the average representative cost of repairing a rotating element is $250. The repair cost per thousand gallons pumped is, then, $250 divided by the totals in Column II. Column VII is the sum of Columns V and VI, or the total power and repair cost per thousand gallons pumped. It will be noted that the values in Column VII decrease to a minimum and then begin to increase. This, of course, is to be expected in the light of the previous discussion.

Fig. 2 shows the relation between the individual cost items asd the elapsed operating time. Curve *A* shows the decreasing repair cost per thousand gallons; Curve *B*, the increasing power cost per thousand gallons; and Curve *C*, the total cost per thousand gallons, which reaches a minimum at about 640 hours. The conclusion is that after 640 hours the worn rotating element should be replaced with a new one to obtain the correct economic balance between power and repair costs. The curve is quite flat in the region of the minimum, so that a few hours' variation from the correct value makes very little difference in the cost.

In conclusion, it is well to point out that physical limitations may prevent the attainment of maximum economy as determined above. For example, pump capacity may fall to a value too low for satisfactory operation, or, since a decrease in the gallons per minute necessitates increasing operating time to handle a given quantity of water, the pump may not be able to meet operating requirements. However, it is well to know the optimum condition and how it is affected by operating limitations, as such knowledge may lead to changes which will increase operating economy.

Fig. 1—Graphic relation between pump output, kilowatt input and hours of operation

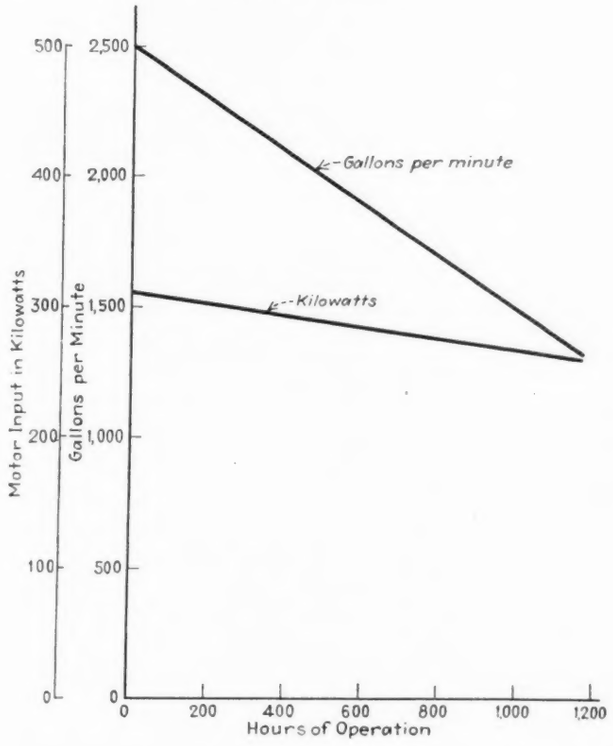
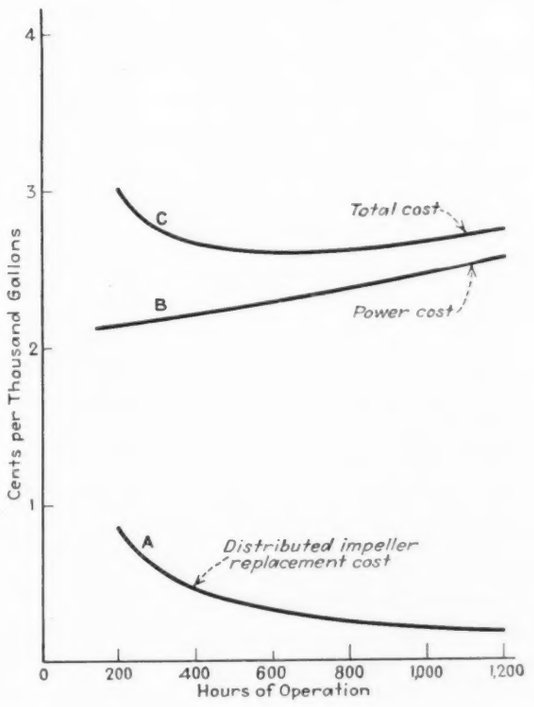


Fig. 2—Graphic relation between repair, power and total costs and hours of operation



NOTES

From Across the Sea

ALMOST driven out of the anthracite breaker, the embattled human slate picker has held his own in the bituminous tipple, working, however, on a decreasing proportion of the entire coal cleaned. Now comes the Birtley Co., Ltd., of Durham, England, with an electric picker that has a thermionic valve which detects and amplifies electric currents and thus makes it possible to distinguish between good coal and slate, which have very different electrical conductivities. It is said to be more unerring in picking slate than the slate picker, who, when fatigued, may fail to remove all the impure material. On the other hand, this machine, like many mechanical devices, bases its judgment on intrinsic qualities, whereas the human picker applies to the problem the same type of judgment as the domestic consumer, who judges "by looks," not by conductivity, electrostatic qualities, specific gravity or even by roughness, by sliding or rolling characteristics on a slope or by color as it affects a photo-electric cell, with which last, by the way, this present equipment has nothing to do. This machine touches the coal and does not look at it.

The Birtley picker occupies much less space than a picking table. It deals with coal ranging in size from 2 in. to 8 in. As now made, it delivers only two products—clean coal and refuse—but it could be arranged to give three or more. The raw coal, after sizing, is fed into a marshaling device—an inclined corrugated trough to which is imparted a circular and jigging motion so that the material—coal, bone or slate—slides into the corrugations, where it is automatically caused to travel, piece by piece, and is delivered to the spacing conveyor, where the speed is such that the pieces are spaced about 18 in. apart and then receive electrical inspection, passing at intervals of a third of a second.

Longitudinal skirt plates are arranged over the belt so as to provide channels through which the raw coal is conveyed, a channel being provided for each corrugation. At the end of the channels the raw coal passes a detector, which consists of fine spring wires connected to the grid circuit of a highly sensitive thermionic valve. These spring wires contact with points on the surfaces of the material to be cleaned, and the voltage applied to the grid will depend on the electrical resistance of the piece of material with which it contacts. If the applied voltage suffices, the valve actuates a relay and completes the circuit of an electrically operated selector mechanism, which consists of a plate arranged at the end of the spacing conveyor and is raised and lowered by a solenoid located immediately above it.

If the material passing through the detector is coal, the plate remains stationary and permits the coal to slide over it. If it is shale, the valve operates the relay, energizes the solenoid and raises a gate which guides the shale out of the stream of coal. To separate raw coal into shale, middlings and clean coal, the cleaner material, after the shale has been extracted, goes to another spacing conveyor, detector and selector mechanism.

BY ADVERSE ORDERS of the Ministry of Transport, acting under authority of the Road Traffic Act, many coal- and coke-burning motor trucks have been driven off the roads, says *Iron and Coal Trades Review*, of London. About 5,000 such trucks have been removed from service, but, beginning in June of this year, a change was made permitting four-wheel steam trucks to have a gross load of 15 tons, 1,360 lb.

Gasoline and diesel-oil trucks are restricted to a gross load of 13 tons, 880 lb. (this reviewer would add, because apparently of their higher speeds and gear changes). Pay load figures about the same for both types of truck, around 8 tons, 1,360 lb., for the steam truck fully loaded with coal and water weighs 7 tons and the average gasoline or diesel-oil truck 4 tons, 1,520 lb. This is perhaps still unfair to the steam truck, for its tires, because of the absence of gear changes, last 15 per cent longer than those of oil-propelled trucks, showing that the roads will be affected less injuriously by the steam truck than by oil-propelled trucks of the same weight.

The Ministry of Transport, however, is still less generous to six-wheeled steam trucks, which are allowed to have a gross load of 22 tons, 800 lb., whereas the oil-propelled trucks are allowed a gross load of 21 tons, 560 lb. Eight-wheeled trucks are at a still greater disadvantage, for all trucks, whether steam or oil-propelled, must have no greater gross load than 24 tons, 1,280 lb.

It is estimated that the 5,000 steam trucks that temporarily were displaced reduced the quantity of coal used between 440,000 and 550,000 tons a year. With favorable conditions, not only these 5,000 trucks but many others might be employed, raising the consumption to 820,000 to 1,650,000 tons annually, retiring many trucks propelled by imported oil.

The modern steam truck has a vertical boiler operating at about 250 lb. pressure per square inch and a superheater, and can be hand or mechanically fired with anthracite, semi-anthracite or coke, but low-temperature coke also may be used, particularly when formed into dense, hard, highly reactive briquets. Steam trucks can easily attain a speed of 20 miles an hour on level roads, and are easier, it is said, to drive and maneuver than oil-propelled trucks. Trolley buses and electric storage-battery trucks are being advocated, for indirectly they also cause native coal to be used instead of alien oil.

AN ARTIFICIAL RESIN called Kunst Harz, made apparently of fine coal and phenol, is being used, says the *Colliery Guardian*, for making wireless cabinets, billiard balls, buttons and even "china" dishes in Germany. The Bielefeld printing house is making use of this composition for the making of half of its type, displacing lead, of which Germany has a rapidly decreasing supply. Thus it has been able to replace that metal by products from its coal mines. The inventor of this development in type making is Heintz Goldschmidt, of Bielefeld.

WITH apologies to our near neighbors, the Canadians, who are not "across the seas," it may be mentioned that Dr. Dudley Irwin, of Toronto University (under direction of Sir Frederick Banting, discoverer of insulin, and with the aid of two officials of the McIntyre mine, W. D. Robson, a surgeon, and J. J. Denny, a metallurgical engineer), has discovered that aluminum dust reduces the solubility of quartz dust and prevents nodules of silica from forming in the lungs. Rabbits kept in a box containing quartz dust developed silicosis, but not when the silica dust was mixed with aluminum dust. The Academy of Medicine in Toronto believes this the most outstanding contribution to the history of silicosis research. However, perhaps its real significance is that some day we may find a dust other than aluminum that will act in the same manner as aluminum dust.

WHY NOT add iron dust to coal, and coke the mixture? That scheme has been tried in this country, but has not found many advocates, though it might conceivably make a strong product out of a feeble coking coal and make use of the iron collected in the dust chambers. In South Russia, where the blast furnaces make a lot of dust when using the Donetz Basin ores, engineers have been making a "ferro-coke," mixing the blast-furnace dust with a coking coal and coking it.

The Russian *Technica* declares that 1,300 tons of this coke was made in 1934 using 30 per cent of ore dust containing 60 to 65 per cent iron and 6 to 13.8 per cent silica. The coke was of satisfactory strength, and about 98 per cent of the iron was reduced to pure iron in the coking process.

In 1935, 600 tons of ferro-coke was made using 30 per cent of flue dust containing about 60 per cent of iron. This coke gave satisfactory results as to

abrasion and strength. During a three-day blast 20 per cent of the ordinary coke was replaced by ferro-coke and later a mixture of 77 per cent ferro-coke was used without any trouble. About 800 tons of pig iron with 0.89 to 2.10 per cent silicon, 2.89 to 3.88 per cent manganese and 0.020 to 0.75 per cent sulphur was made. Manganese content was kept high, as the coal had an undue percentage of sulphur. The Russian iron industry is said to propose to make more accurate tests and to use ferro-coke permanently in its blast-furnace practice.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Coal Mines Act, 1911, Regulations and Orders Relating to Safety and Health, 1936 Edition. British Library of Information, New York. 184 pp., 6x9¾ in.; paper. Price, 50c.

This book does not contain the Coal Mines Act, 1911, but all the regulations and orders promulgated by the Mines Department up to Jan. 1 of last year (1936). It is, therefore, only a part of the whole body of mining law, and in it are listed the makes of safety lamps, lamp glasses, electric-lamp bulbs, firedamp detectors, electric shotfiring equipment, breathing apparatus, smoke helmets and other rescue appliances; also explosives, signaling and telephone equipment that have been approved by the department. Electrical equipment, in general, is excluded, for the camel is so large it would carry away the tent if admitted.

Provisions are given under which two main intakes are not required: namely, wherever a second main intake airway might increase fire risk from spontaneous combustion, wherever the construction of such a second intake airway might cost so much as to prevent the seam being worked at a profit, wherever lease- or freehold is insufficiently wide to provide for such airways and pillars, wherever in the Cleveland district stratified ironstone is being mined, or in oil-shale mines and other mines of a similar nature, so defined by the British Board of Trade, and wherever less than 100 men are employed or the seam is wet throughout.

The reader will realize the severity of the British restrictions as set forth in part in this publication, but he will feel that he is being let down with a jolt, comparable with those one receives when reading our State laws, when he finds a paragraph on the "Storage and Use of Candles and Paraffin Wax" and reads that when "used in the mine below ground" they "shall be placed in a metal holder which shall be of such design that when fixed to a prop the flame of the candle cannot set fire to the wood." So they are still used below ground in some British mines, but perhaps not in coal mines. The inspector of the division has to give a written exemption or they cannot be stored below ground.

Notice has to be given of the intention to introduce electrical equipment into any mine or any ventilating district in any mine, but, if the division inspector does not object in writing within a month, the owner can install the equipment, even though, apparently, electricity previously has been prohibited. This does not apply to telephones or signaling equipment. Sanitary conveniences with portable metal receptacles must be supplied in or adjacent to the hoist house, near the pit bottom and at suitable positions along the main roads. Disinfectant or dry coal dust must be provided for such places. American operators please note.

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Statistical Analysis of the Progress in Mechanical Cleaning of Bituminous Coal From 1927 to 1934, by L. N. Plein, U. S. Bureau of Mines. Economic Paper 18, 25 pp.; paper. Price, 10c.

This monograph on mechanical cleaning does not cover cleaning by jump-the-gap pickers, by spirals, by Bradford breakers and by oil flotation. "Mechanical cleaning," says this economic paper, "refers only to results obtained by mechanical devices that effect a separation of impurities from the raw coal by reason of differences in specific gravity, actual or induced. These machines fall into the broad classes of jigs, wet tables, classifiers, launders, pneumatic tables and hindered-settling pneumatic machines." The treatise, therefore, does not cover all forms of mechanical cleaning of bituminous coal as generally understood, though it covers most of them.

Most of the types omitted are of limited application and, therefore, are likely to be in such restricted use that the inquiry, if extended to and reported in detail, would reveal to the well-posted reader the tonnage prepared by specific plants and in some cases would involve duplications of the same tonnage, for the coal is sometimes twice prepared, not only by more usual systems of preparation but also by less usual methods. Thus coal cleaned by Bradford breaker is afterward cleaned by the wet process, as at the Talleydale plant, or is cleaned by one of the processes used in the monograph's classification and then by the flotation method, as at some of the plants of the Pittsburgh Coal Co. The U. S. Bureau of Mines does not feel justified in seeking and publishing records that thus can be identified.

Percentage of total coal mined which is cleaned by the means covered by the report have increased from 2.7 per cent in 1906 to 10.0 per cent in 1934. Current practice in 1934 was to clean mechanically 47 per cent of the output of the mine, from which it may be deduced that, of the sizes of coal normally cleaned by "mechanical cleaning," about 21.3 per cent are now being so cleaned. Thus a possible increase of 78.7 per cent still remains as a goal to be attained. Future progress, however, may involve new and better processes for at least some of the coal now cleaned and the extension of the mechanical cleaning process to sizes not now thus treated.

It is to be hoped that the public will not fail to realize that during the period covered by the report mechanical adjuncts to hand cleaning at the tipple and to improved cleaning at the face have wrought large changes in the quality of the 53 per cent of the sizes of coal not yet usually mechanically cleaned.—R. D. HALL.

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The Rosebud Coal Field, Rosebud and Custer Counties, Montana, by W. G. Pierce, U. S. Geological Survey. Bulletin 847-B; 120 pp., with map pocket. Price, $1.25

This bulletin describes the geological features of an area just south of the Yellowstone River, in which the exposed rocks belong to the Lance formation (which may be all Tertiary, though parts have been credited to the Cretaceous) and to the Fort Union, which lies above it and is recognized as of Tertiary age.

Rosebud bed, from 5 ft. 8 in. to 11 ft. thick, has been almost entirely eroded; McKay bed, 4 ft. 6 in. thick, has quite a limited area. Still going lower, the Flowers bed, about 8 ft. thick, appears but has been greatly eroded. Spreading over a large area are the Terret bed, which ranges from 1 to 15 ft. in thickness and often is split, and the Burley bed, still more extensive but only 1 to 9 ft. thick. All these seams are in the Tongue River member at the top of the Fort Union formation; the rest are relatively unimportant.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Locomotive Maintenance Cost Reduced by Shop Jigs

Labor saving and assured accuracy are the advantages afforded by a jig outfit consisting of three mandrels with journals of identical size, two pairs of pedestals with bolted caps to accommodate the mandrel journals, and two cross-plates, all of which have been built in the Jenkins (Ky.) shop of the Consolidation Coal Co. to facilitate machining arc-filled surfaces of worn locomotive motors. These tools simplify the machining work to such an extent that they saved their cost on the first three or four jobs.

The main haulage and gathering equipment of the mines served by the Jenkins shop include but four types of motors: Nos. 801, 803, 711 and 809; all General Electric. The 711 and 809 types are identical in so far as the pertinent frame dimensions are concerned, therefore but three mandrels are required. These have cores of the correct size for being clamped into the motor frames, and each mandrel is stamped with the type number or numbers for which it is intended.

Two pedestals of a height sufficient for the largest motor (Fig. 1) are used for holding the mandrels to exact alignment while planing the surface for the axle caps. These pedestals have longitudinal keyways for use in keying them to the planer bed, thus insuring the alignment.

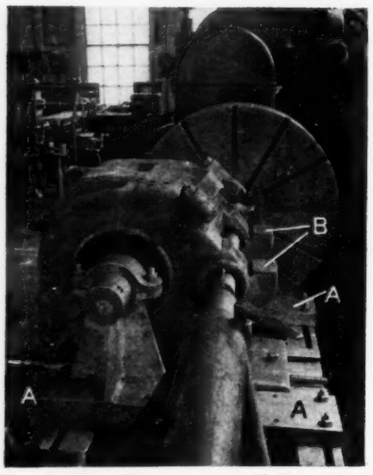


Fig. 2—Keyed to a standard dimension from armature center to axle center

For boring the fits for axle brasses (Fig. 2) a different pair of pedestals is bolted onto cross-plates (*A*) which in turn are bolted to the lathe carriage. Transverse keys hold the pedestals in a definite position on the cross-plates and keys also position the cross-plates on the carriage. Three keyways in the bottom of each pedestal provide the three positions for the three sizes of motor frames and these keyways are marked with the respective motor-type numbers.

The operation of machining the axle boxes is done with a boring bar held in the lathe. Both boxes are machined without changing the position of the motor frame. Arrows *B*, Fig. 2, point to solid caps which have been welded over the grease boxes in place of the hinged covers of the original equipment. These welded covers will be drilled and tapped for 2-in. pipe plugs.

Fig. 3 shows the machining of the frame-head fit. In this case, the mandrel, with the motor frame clamped over it, is mounted in the lathe and the cutting tool is mounted on the carriage. The work must be turned end for end in the lathe in order to complete the machining of the two ends.

Fig. 1—Held in exact alignment on the planer bed

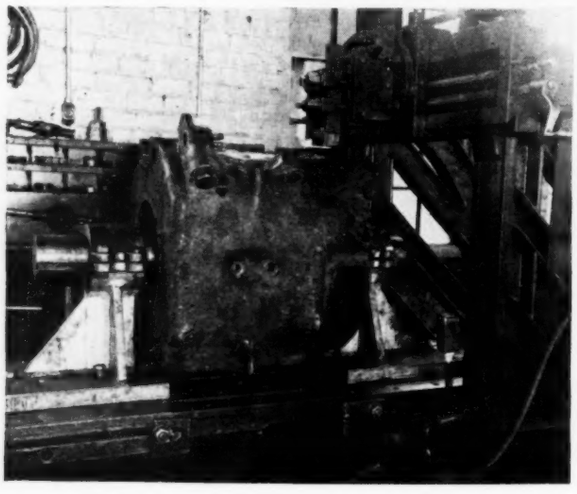
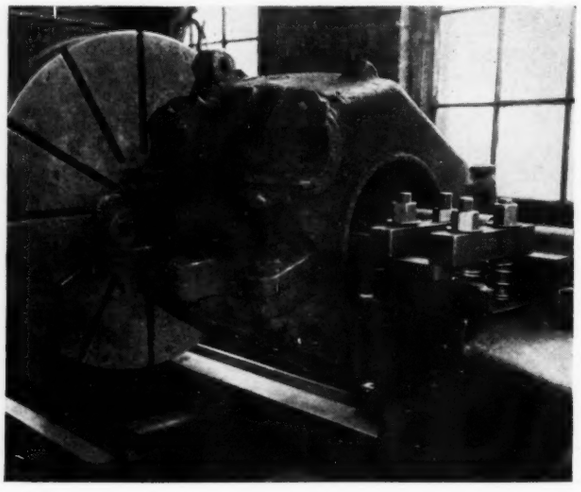
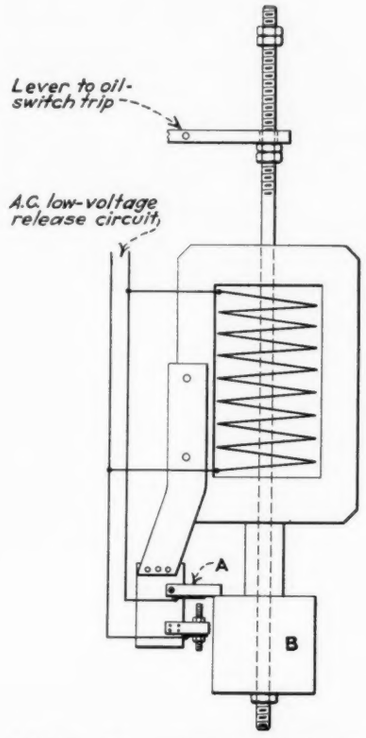


Fig. 3—Assuring concentric boring of housing fits



Auxiliary Contact Improves Old-Style L. V. Release

When the Koppers interests took over the Beards Fork (W.Va.) mine, which is now included in the Powellton division, substation difficulties were encountered due to unreliable action of the old-style low-voltage releases on the a.c. oil switches feeding the converter transformers. The difficulty was overcome by adding a small auxiliary contact which in normal position is held open by the armature of the release.



Adding the contact eliminated a chronic control difficulty

Difficulties were twofold: It was possible to close the oil switch without raising the armature to its highest point. Thus, upon failure of voltage across the coil, the armature did not drop far enough to have sufficient energy for operating the oil circuit breaker trip. Even though the armature were at its highest position, sometimes it would not drop properly if the voltage failed gradually.

In the accompanying drawing, the attachment is at the lower left. *A* is a fiber arm pivoted at one end and at the other carrying a contact which short-circuits the holding coil of the release when closed. Thus, the coil cannot be energized unless the armature is raised high enough to contact the fiber arm. Upon a reduction in voltage sufficient to allow the armature to move down approximately 1/16 in., the auxiliary contact closes, thus deenergizing the coil and effecting sudden release of the armature.

The substation units are 200-kw. 275-volt synchronous converters. Several times before the auxiliary contacts were added, these converters were subjected to the severe treatment of full-voltage starting through voltage release failure, but since the improvements were made no instances of that type have occurred.

Mine-Cable System Guarded By Ground Indicator

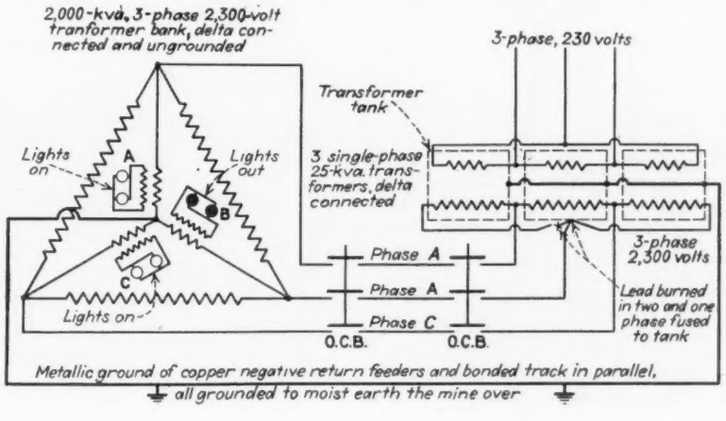
"A ground indicator installed at the beginning of 1937 has practically eliminated the intermittent interruptions experienced in months past on the 2,300-volt a.c. cable system used underground at the Kathleen mine of the Union Colliery Co., Dowell, Ill. Upon the installation of this equipment, a visible indication of an existing ground was immediately witnessed," writes R. R. Richart, electrical engineer. "This ground was traced to a transformer station 2¾ miles inside the mine, and the conditions found are pictured graphically in the accompanying figure. One lead of the 2,300-volt system was grounded against the case of the center transformer. The transformer to the left was dead, since one lead of the primary was still connected but the other lead was burned in two and was lying on sand and rock dust.

"The mine section served by the station, however, still received 3-phase 230-volt power from the secondary side of two transformers now operating in open delta. The load was not heavy, so there was no complaint of bad power, even though the capacity of the two transformers was only 58 per cent of the original station capacity. At the spot on the center transformer case where the 2,300-volt lead was grounded a crater 1½ in. in diameter and ¼ in. deep had been eaten out by this arcing ground. It so happened that this particular transformer had a heavy cast-iron case and the crater was not deep enough to allow the oil to leak out and create a fire hazard.

"This transformer station was in use only on the day shift. Very often a 2,300-volt cable would fail the first thing in the morning, indicating that during the night a ground would appear on the main circuit to be followed by a cable fault when this transformer station was reconnected.

"The detector in question indicates grounds on any of the 2,300-volt equipment, be it cables or rotating equipment on top or below. It is now possible to tell when any phase of the 2,300-volt cable becomes grounded and to locate the particular section by isolation by means of oil circuit breakers. Then the particular section can be blown up at such a time as will not interfere with the normal operation of the mine. This ground detector, and

Ground condition encountered and method of installing ground indicator



Mickles

•One of the best evidences that the Scots are a canny race is the saying "Many a mickle makes a muckle." Operating, electrical, mechanical and safety men at the mines will find this maxim equally applicable in their daily activities, as little savings, oft repeated, add up to a sizable sum over a period of time. Frequently, this little saving, and quite often a big one, is the product of a new twist of thought as applied to an existing machine or condition. These new twists are the function of this department, which solicits your aid in extending its usefulness to the men at the mines. So send in your idea, together with a sketch or photograph if it will help to make it clearer. Each acceptable idea will bring its sender $5 or more from Coal Age.

★ ★

the replacement of part of the old cable, has prevented any loss of time due to 2,300-volt cable trouble so far this year.

"In the figure, *A*, *B* and *C* are 20/1 50-va. potential transformers with one side of each primary connected to a common ground and the other sides connected to the respective phases of the 2,300-volt system. Across each secondary are two 15-watt 115-volt red lamps. Normally—when the 2,300-volt system is clear of grounds—all the lamps burn with equal brightness. As soon as one phase becomes grounded—in this particular case, Phase *B*—two of the lamps go out and the other four burn brighter. While not shown in the figure, both the primary and secondary windings of the potential transformers are fused."

Hints From a Shopman's Notebook: Jig for Indexing Splines

By WALTER BAUM
Master Mechanic, Perry Coal Co.
O'Fallon, Ill.

BELOW is described a jig for indexing the splines on Joy 5BU and 11BU caterpillar shafts and 5BU armature shafts, all of which have No. 10 standard splines. I have made these shafts of special heat-treated steel and thus reduced breakage. As only a 10-in. hand-milling machine was available and no way of indexing the shaft while cutting the splines, the jig was made for both holding the shaft and indexing.

First, I took the spline end from one of the broken shafts, chucked it true in the lathe, bored it out and cut 1¾-in. SAE threads in it to fit the thread end of the new shafts, all with 1¼-in. SAE threads 1¾ in. long. After cutting the threads in the spline end, a 13/32-in. hole 2 in. deep was drilled in the shaft. Then the splines were turned down for a distance of ½ in. Next, the threaded end was cut off to a length of 1¾ in. with a cutting-off tool and the 13/32-in. hole was tapped out with a ½-in. No. 13 USS tap to receive the pointed setscrew shown in Fig. 1.

The next step was to cut out the corners of a piece of 1¼x4x32-in. mild steel and split it as shown in Fig. 2, using a hand torch. Then the ends of the plate were heated in the forge and bent as in Fig. 3, after which the ⅝-in. and one ⅜-in. holes shown in Figs. 2 and 3 were drilled. The plate then was mounted on the compound of the lathe so that the ends could be reversed for drilling the 1¾-in. hole (Fig. 3) and the ⅞-in. hole that later was tapped out with 1-in. No. 8 USS tap.

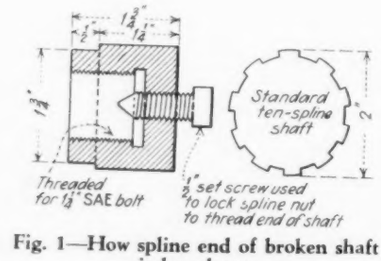


Fig. 1—How spline end of broken shaft is bored out

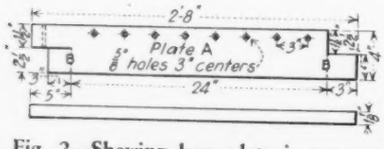


Fig. 2—Showing how plate is cut out and split

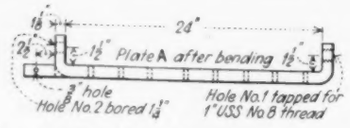


Fig. 3—Method of bending ends and drilling plate shown in Fig. 2

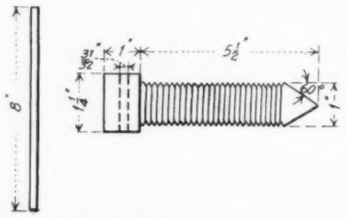


Fig. 4—Details of T-handle screw used in Hole No. 1 of plate shown in Fig. 3

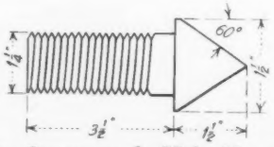
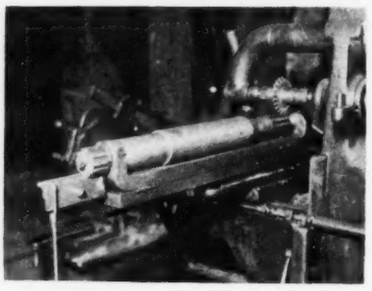


Fig. 5—Center to fit Hole No. 2 of plate shown in Fig. 3



Shaft in place in jig, showing splines already cut

The T-handle screw (Fig. 4) was made of heat-treated steel with 1-in. No. 8 USS threads to fit Hole No. 1 in the plate (Fig. 3). The point is made to fit the centers in the ends of the shafts. Construction of the center shown in Fig. 5 to fit Hole No. 2 in the plate (Fig. 3) was the next step. The back end was threaded with 1¼-in. SAE threads to accommodate a nut for holding the center in place. This center is used to hold short shafts in between centers while cutting keyways in them.

The plate shown in Fig. 3 was bolted to the table of the milling machine as shown in the halftone. The spline nut was put in place and the pointed setscrew was run up to keep the nut from moving or turning. Next, the piece detailed in Fig. 6 was made and bolted to the plate as in the halftone. Using ¾-in. steel welding rods, the foot attachment shown in Fig. 7 was made. It is used to hold the stop (Fig. 6) tight against the spline nut while the shaft is locked in position, and leaves both hands free for other purposes. With the shaft in position, the first spline is cut. Then the stop is loosened; the shaft, with spline nut, is turned, and the stop again is tightened to lock the shaft in the new position. Splines cut in this manner were found to fit the female splines snugly.

To cut the splines on the armature shafts, which are much longer, a plate similar to that shown in Figs. 2 and 3

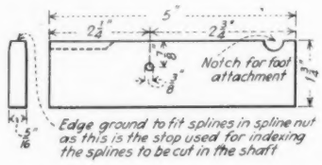

5"
2½"
2¾"
Notch for foot attachment
Edge ground to fit splines in spline nut as this is the stop used for indexing the splines to be cut in the shaft

Fig. 6—Details of stop used in indexing the splines

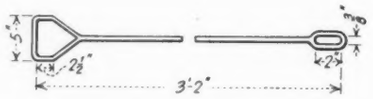
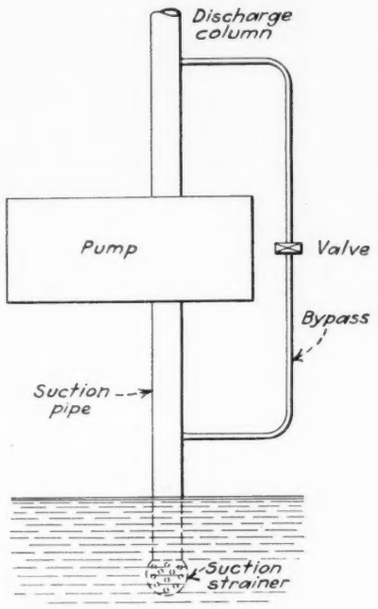


Fig. 7—Construction of foot attachment

was made long enough to accommodate the extra shaft length, using the spline nut and T-handle from the smaller jig. To cut the straight keyway in the thread end, the shaft was reversed. I used a ground-form cutter to cut the splines. This cutter will do for all the shafts in question.

Suction Strainer Cleared By Bypass Line

To facilitate clearing clogged suction strainers, P. W. Brown, mining department, Fife Coal Co., Ltd., Cowdenbeath, Fifeshire, Scotland, suggests the use of a bypass arrangement such as that indicated diagrammatically in the accompanying sketch. By opening the valve, the water head in the discharge column may be employed in clearing the strainer.



Opening the valve directs water into the bypass line to clear the suction strainer

Manufacture of Trolley Poles Speeded by Using Planer

Making round trolley poles on a metal-working planer sounds contradictory but is done to excellent advantage in the Jenkins (Ky.) shop of the Consolidation Coal Co. The planer bed is used as the support for a motor-drive head and tailstock and the woodworking lathe thus improvised is moved past a cutting gouge held in the planer head. Ordinarily a man makes 100 poles per day, but could average 150 if he were supplied with selected material and not interrupted.

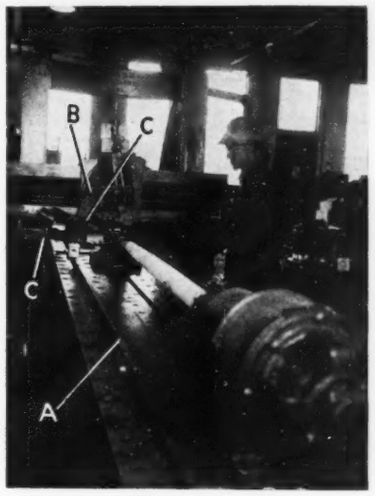
The drive head consists of a 2-hp. 1,750-r.p.m. d.c. motor direct-connected to a headstock with spur center, both mounted on a small baseplate. When the planer is to be used for making trolley poles the drive head plate is hoisted to the planer bed and bolted in the center at one end. A tailstock with single ball thrust bearing between its cup center and the adjustable arbor also is bolted to the bed at the proper distance from the drive head to make the particular length of pole required.

To prepare the planer head for the job the regular tool rest is removed and the feed screw gear of the compound head is taken off so that the head is free to slide up and down. Its travel is controlled, however, by a bell-crank lever added to the head. The lower arm of this bell-crank rests and rides upon the top edge of a long tapered guide clamped to the planer bed. An adjustable tool rest borrowed from a metal-working lathe is attached to the planer head and in this the gouge tool is clamped.

Weight of the planer head is sufficient to keep the tool down to the limit allowed by the bell-crank lever. When the work is spinning and the planer-bed motion is engaged, the movement of the guide sliding along under the end of the tool-head lever causes the tool to make a cut of the proper contour. Three cuts complete the turning of a pole from square stock. The tool rest is marked to indicate the proper adjustments of cutting-tool starting height for each of the successive cuts.

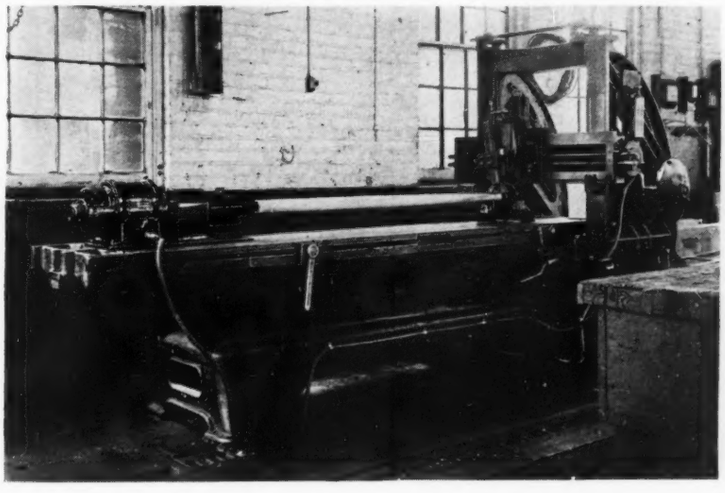
As safety guards for the lathe operator and other men working near him and also as steady rests to reduce vibration of the pole, levers are provided which the operator holds down against the top of the pole after the first or second cut. Even so a pole being turned from stock that contains knots may break, but the guards keep the pieces from flying in a dangerous manner.

Ash and hickory, as available, are the two woods used and usually these are worked while green. Two sizes and shapes of poles are made, one for use at Van Lear No. 155 mine and the other shape for the several mines (three tipples) operated at or near Jenkins. Two guides of different lengths and shapes are required and to change to the manufacture of the second type of pole the first guide must be removed and the second substituted.



***A* is the tapered guide; *B* the lower arm of the bell-crank lever; and *C* designates the pivot points of the guard levers which the operator is holding down against the pole**

The planer table becomes the lathe bed and the cutting tool remains stationary



WORD FROM THE FIELD

N.C.A. Launches Campaign For Bituminous Coal

A market-promotion compaign to acquaint the American public with the advantages of heating homes with bituminous coal has been launched by the National Coal Association. As the first step it has started the distribution of a magazine entitled *Small Homes* containing a page "ad" sponsored by the association and the Stoker Manufacturers' Association setting forth the attractive features of bituminous coal and the modern, economical way to heat homes. On pages adjoining the "ad" is an article on modern coal heating and air conditioning. The publication is to be distributed throughout the nation through sample or demonstration houses, 2,500 of which are being built and sponsored by lumber dealers.

A smaller pamphlet also is to be circulated to retailers, coal producers, heating engineers, stoker manufacturers, architects, engineers and home owners in which the magazine "ad" will be elaborated upon with respect to the construction of basements with modern coal bins in addition to setting forth other advantages of bituminous coal. The association points out that there is a kind and grade of bituminous coal for every requirement, and asks the support of the various sales organizations in the industry.

Recourse to the radio was taken on July 9, when a nation-wide hook-up on the Columbia Broadcasting network was used to publicize the "small homes" building campaign. Frederic Delano spoke from New York; Stuart McDonald, head of the Federal Housing Administration, spoke from Washington, and others interested in the program delivered addresses from other points.

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Union Pact Signed in Harlan

A wage agreement with the United Mine Workers covering four mines employing 1,500 men was signed late in June by the Harlan-Wallins Coal Corporation, operating in Harlan County, Kentucky, according to a union announcment. The new pact, which is based on the appalachian agreement, calls for $5.60 base day rate, 65c. a ton base loading rate, 10c. a ton cutting rate, time and a half for overtime, and a 7-hour day, 35-hour week. This is the first major agreement obtained by the U.M.W. since it began its unionization drive in Harlan County.

Union officials charged before the National Labor Relations Board in Washington on July 10 that the Harlan

County Coal Operators' Association had violated the Wagner Labor Act. A. D. Lewis, brother of John L. Lewis, U.M.W. president, said that the charges included coercion, intimidation, promotion of company unions and discharge for union activity. He added: "We asked the Labor Board to investigate these charges and to hold a hearing, if possible in Washington." The charges were made against 27 member companies of the operators' association.

Keeping Step With Coal Demand

Bituminous Production

	1937 (1,000 Tons)	1936* (1,000 Tons)
June 5	6,600	6,430
June 12	6,995	6,697
June 19	7,112	6,698
June 26	7,148	6,867
July 3	7,235	6,481
July 10	6,420	6,827
Total to July 10	231,427	208,170
Month of May	**29,980**	**28,684**
Month of June	**31,560**	**29,217**

Anthracite Production

June 5	959	866
June 12	1,069	911
June 19	956	881
June 26	893	1,127
July 3	982	939
July 10	667	845
Total to July 10	28,874	30,827
Month of May	**4,207**	**5,121**
Month of June	**4,471**	**4,306**

* Outputs of these two columns are for the weeks corresponding to those in 1937, although those weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

	(Thousands of Net Tons) June 1 1937	May 1 1937	June 1 1936
Electric power utilities	8,428	8,504	5,613
Byproduct ovens	8,242	8,544	3,515
Steel and rolling mills	1,603	1,748	807
Railroads (Class 1)	7,405	8,206	4,674
Other industrials *	12,559	12,719	6,837
Total	38,237	39,721	21,446

Bituminous Coal Consumption

	(Thousands of Net Tons) June 1 1937	May 1 1937	June 1 1936
Electric power utilities	3,206	3,294	2,711
Byproduct ovens	6,427	6,247	4,993
Steel and rolling mills	1,157	1,226	1,157
Railroads (Class 1)	7,227	7,472	6,841
Other industrials *	11,283	12,213	9,515
Total	29,300	30,342	25,217

* Includes beehive ovens, coal-gas retorts and cement mills.

Soft and Hard Coal Groups Oppose '7 T.V.A.'s'

Senator Norris' bill providing for T.V.A.'s seven sisters—regional valley authorities embracing the entire country—has elicited sharp criticism from representatives of both the bituminous and anthracite industries. They charged that the stupendous government hydro-electric power program, masquerading as flood control, contemplated by the bill would result in the ultimate annihilation of the coal industry.

Appearing before the Senate subcommittee on agriculture, holding hearings on the Norris measure, J. D. Battle, executive secretary of the National Coal Association, strongly opposed its enactment. "Facts which we believe can be neither controverted nor escaped," said Mr. Battle, "impel the conclusion that any such far-flung program is calculated in the long run to spell the doom of our industry through the gradual and relentless displacement of coal by government-owned and government-subsidized hydro-electric power sold below cost.

"Our industry is entirely sympathetic to the increased use of electricity," continued the witness. "We are perfectly willing to participate in the promotion of its increased use. We know that in nine cases out of ten electric power generated from coal by steam is more economical than water power." The program contemplated, he pointed out, would furnish 276 billion kilowatt-hours of electricity, equal to the consumption of 199 million tons of coal annually.

What these figures mean can be visualized, the witness continued, when it is realized that every million tons of coal displaced means:

"The loss of over $1,000,000 annually in the pay envelopes of mine employees, for 65 per cent of the cost of producing coal is labor cost.

"Loss in railroad freight revenue of over $2,000,000, and 50c. of each railroad revenue dollar goes to labor.

"Elimination of 20,000 carloads of coal—400 trains of 50 cars each—and elimination of the employees required to operate them.

"Elimination in the aggregate of 1,000,000 workdays—each ton of coal lost being estimated to represent the loss of one day's work directly or indirectly employed in production and distribution."

Opposition of the anthracite industry to the proposed legislation was expressed on July 7 by Louis C. Madeira 3d, executive director, Anthracite Institute. "We believe it to be against the entire public interest," he said. "Two of the greatest problems confronting the

country today are rising costs of government and the welfare of several millions of unemployed, yet here is a bill that will add uncounted billions of dollars to government expenditures to the end that there will be further unemployment in such places as mines, breakers, railroads, fuel yards, motor vehicles and allied industries.

"It is inevitable, if this proposed legislation goes through, that the government will be selling electricity in competition with other fuels at less than cost, and that the actual cost of such electricity will be lost in a maze of accounts, allocations and disputed claims. This is not conjecture; it is what is happening today under T.V.A.

"Even the Federal Government cannot produce electricity for nothing, or almost nothing. If the user gets it for less than cost, somebody has to make up the difference. In the case of T.V.A. power, that somebody is the taxpayer. The operations of T.V.A. to date have not been such as to inspire confidence in a proposal for a like plan for the entire country."

The administration proposal to create a national system of regional T.V.A.'s would "hydro-electrocute" the coal industry, said Representative Andrew J. May, of Kentucky. He added that the Norris measure outlined "a Utopian venture into the field of socialistic activities fraught with danger to democratic institutions." Representative May's opposition to the bill, he explained, was based on the fact that he represented a large coal-producing district.

New Mine for Alabama

The first new major coal-mine development in Alabama in many years has been announced by the Galloway Coal Co., which has started construction of a new operation in Walker County to represent an investment of approximately $300,000. The new mine, to be designated as the Hope, will tap the Black Creek seam, produce about 1,500 tons daily and give employment to about 300 miners, according to Frank Cobb, general manager. Production is expected within a year.

To Make Mechanical Study

Dr. Walter N. Polakov has been appointed by John L. Lewis to make a study for the United Mine Workers of mechanical mining in coal operations of the United States in relation to wages. As president of the miners' union Mr. Lewis was authorized by the international executive board to make the appointment in conformity with a provision of the latest Appalachian wage agreement which called for such a study. Dr. Polakov, who is a management engineer, has been connected with the W.P.A. in research work. His mechanical mining study also will include research.

Classification Hearing Shows Agreement On Proposed Code Standards

WASHINGTON, D. C., July 21—Substantial agreement on standards for classification was expressed by spokesmen for the operators at a two-day hearing before the National Bituminous Coal Commission, held at the Carlton Hotel, Washington, D. C., July 15-16. Taking their cue from General Order 17 of the 1935 Commission, representatives of the district boards generally proposed that these standards should include: (1) Chemical analysis, (2) physical characteristics, (3) plant-performance characteristics, (4) market history and sales experience, and (5) values as to uses. This last standard, not part of the 1935 commission order, threatened to be a storm center as members of the Commission sought specific information as to why it had been added.

What the industry needs, declared Chairman Hosford, is simplification. Complicated classifications, he warned, will not be permitted to throw the industry back into a chaos of price cutting. "It is a new kind of competition to devise a use classification under which coal again would practically be given away to consumers." Use-classification, said Commissioner Tetlow, should either be precisely defined or omitted. "I think it entirely out of place," he added. Henry Warrum, general counsel, United Mine Workers, also inveighed against the use standard, which, he intimated, was being proposed in order to enable certain consumers—particularly the railroads—to detour the law.

J. A. Geyer, District 1 (eastern Pennsylvania), and F. Y. Casey, District 2 (western Pennsylvania), insisted that the use-value standard had been included to comply with the express provisions of the Guffey-Vinson act. Mr. Casey also felt that sizes might well be considered in classification because of differences in quality and performance between different sizes of the same coal. C. J. Potter, District 3 (northern West Virginia), declared that use-value was inherent in any attempt to classify a product. Speaking for District 4 (Ohio), P. C. Sprague said that the original proposals submitted by his district had followed General Order 17, but that "value as to uses" had since been incorporated to conform to the proposals of other districts.

This position also was taken by Hugh B. Lee, District 11 (Indiana), who pointed out that preparation practices, too, might well be a factor in classification. A large number of values and uses, he explained, does not necessarily mean a large number of prices; the commission can take care of that situation in coordination. Inclusion of the use-value standard, said J. N. Terrio, District 6 (West Virginia Panhandle), will make no difference in actual classification results in his area, but may be important in fields producing special-purpose coals. Such a classification, he added in answer to a question from Chairman Hosford, may be required to protect special-purpose coals "from themselves."

The interrogatory drum-fire died down after John L. Steinbugler, District 7 (Southern low-volatile), discussed the legal and practical aspects of values as to uses at the opening of the second day's hearing. Subject to the preservation of equality of opportunity in competition, he maintained, the law not only authorizes but requires the fixing of minimum prices based upon use. The same coal, he pointed out, may have one value for coking and another for general industrial uses; in the first instance, a difference of 220 deg. F. in ash-fusion temperature may be insignificant, while in the second it may be controlling in a sale. Thus, if Coal A, because of lower fusion temperature, was priced 5c. per ton under Coal B—without limitations as to use—Coal A would not only be able to compete on equal terms with Coal B in the industrial market but, other things being equal, would drive Coal B out of the byproduct field.

Sees Selectivity in Buying

If differences in prices are to be based upon differences in consumers, Commissioner Tetlow felt that the Commission should have specific information as to the different classes of consumers involved. He foresaw a trend toward greater selectivity in coal buying. The day may come when the Commission may be called upon to base price differentials on differences in combustion equipment; that day, however, has not arrived, concluded the Commissioner. There may be cases, too, he commented, where inter-industry competition compels prices which on first blush appear uneconomic but which are necessary if the industry is to survive.

W. P. Neecamp, District 8 (Southern high-volatile), indorsed the position of preceding district spokesmen. But J. R. Henderson, District 10 (Illinois), claimed that "market history and sales experience" had no place in classification standards and should not be used to perpetuate unfair competitive conditions. If this history and experience are to be considered, such consideration should come in price fixing and coordination. George F. Klein, District 15 (Southwest), took issue with this view. So, too, did M. F. Soule, speaking for the Northern Illinois Coal Association. Both protestants insisted that these factors should be weighed in intra-district, as well as in inter-district, coordination and so had a place in classification standards.

While accepting the standards proposed by Dr. Potter and other witnesses who had agreed to those proposals, H. S. Salmon, District 13 (Alabama),

stated that he would have to submit them to his board for formal approval. Alabama, he explained, had taken many other factors into consideration in arriving at classification standards for coal in that State. These factors included the employment of labor, consumer acceptance, special uses, inter-district competition, competition with other forms of energy, transportation methods and charges, consumer requirements as to sizes and existing fair competitive relationships. When recommending the five-standard classification, therefore, he would recommend it without limitation on the consideration of other factors or the weight to be given them.

Restrict Size Groups to Four

R. N. Davis, speaking as an individual northern West Virginia operator, urged the Commission to limit the number of size groups in fixing minimum prices. He suggested that one base price be fixed for each of the following four groups: (1) ¾-in. slack, (2) all sizes from plus ¾-in. to 6-in., (3) lump, and (4) mine-run and nut-and-slack. The consumer, he argued, should not be penalized in price because of his equipment, as all coals in the ¾x6-in. range, for example, have the same heating value. Consideration of the standards worked out by the A.S.T.M. committees on coal classification was advocated by H. T. Coates, National Association of Purchasing Agents. The work of the A.S.T.M. committees was explained by A. C. Fieldner, chairman of the sectional committee on classification of coal sponsored by that organization.

An order issued on July 15 requires code members to file with the Commission copies of all contracts as well as of spot orders for coal. All past orders are to be filed within 20 days and future orders are to be filed within ten days of their receipt. The data are to be filed with the statistical bureau for the district in which each mine is located.

All producers, whether code members or not, are required by an order issued by the Commission on July 16 to furnish complete reports showing total costs of tonnage and realization prices on all coal produced and sold in 1936. Cost forms are to be supplied by the Commission and separate reports must be made for each mine.

The first of a series of local hearings to decide what, if any, coal produced in various States does not directly affect interstate commerce in coal and therefore will be exempt from the bituminous coal code, will be held July 28 at Columbus, Ohio. Chairman Hosford said that similar hearings will be held as promptly as possible in other bituminous-producing States until all are covered. At a preliminary hearing on the relationship between intrastate and interstate coal held July 12 in Washington Robert W. Knox, acting general solicitor for the Commission, gave a general survey showing a wide variation in conditions. In Pennsylvania, for instance, about 90 per cent of the 61,000,000 tons used is produced within the State and only 10 per cent comes from outside, whereas in Michigan less than 2 per cent of the 25,000,000 tons consumed is produced in that State.

Producers' representatives, however, contended that practically all coal produced locally affected the price of coal in interstate commerce.

A hearing scheduled for July 19 to determine questions involved in regulating discounts and trade practices of wholesalers has been postponed until Aug. 3. The hearing, which will be public, will be held at the Carlton Hotel, Washington.

Producers representing 95.9 per cent of the bituminous tonnage of 1936 had filed acceptances of the code on July 3, according to an announcement by the Commission.

The 12-story Walker Building, at 734 Fifteenth St., N.W., now nearing completion, will be occupied by the Commission about Sept. 1. The entire structure, comprising 60,000 sq.ft. of floor space, will be taken in order that the organization will not have to be scattered, as at present, with offices in three different buildings. Incidentally, the bituminous statistical staff of the U. S. Bureau of Mines was transferred to the Commission on July 10. The Commission proposes to expand the bituminous information service built up by the Bureau of Mines.

A series of hearings on applications for provisional approval of marketing agencies has been set by the Commission to be held in Washington on July 26-29.

The personnel of the district boards set up under the act is as follows:

District 1 (Eastern Pennsylvania)—Charles O'Neill (chairman), president, United Eastern Coal Sales Corporation; James H. Allport, president, Rich Hill Coal Co.; L. G. Ball, vice-president, J. H. Weaver & Co.; Charles G. Berwind, vice-president, Berwind-White Coal Mining Co.; James R. Caseley, president, Buffalo & Susquehanna Coal & Coke Co.; H. S. Clark, president, Rochester & Pittsburgh Coal Co.; G. Dawson Coleman, president, Ebensburg Coal Co.; William E. Miller, president, Baker-Whiteley Coal Co.; Charles A. Owen, president, Imperial Coal Corporation; D. T. Price, general manager, Lochrie-Price Coal Co.; Mark W. Potter, president, Pennsylvania Coal & Coke Corporation; Charles M. Shoffner, president, Allegheny River Mining Co.; J. Noble Snider, vice-president, Consolidation Coal Co.; Arthur B. Stewart, president, Davis Coal & Coke Co.; J. William Wetter, vice-president, Madeira, Hill & Co.; Robert W. Wigton, secretary-treasurer, Morrisdale Coal Mining Co.; James Mark, employee representative.

District 2 (Western Pennsylvania)—R. E. Jamison (chairman), secretary, Jamison Coal & Coke Co.; R. R. Bowie, proprietor, Pine Township Coal Co.; H. E. Booth, vice-president in charge of sales, Pittsburgh Coal Co.; E. W. Bratton, vice-president, W. J. Rainey, Inc.; A. R. Budd, vice-president, Hillman Coal & Coke Co.; O. E. Eberly, partner, Old Home Fuel Co.; H. L. Findlay, vice-president, Youghiogheny & Ohio Coal Co.; E. B. Leisenring, president, Westmoreland Coal Co.; George H. Love, president, Union Collieries Co.; J. B. Moore, president, Fancy Hill Coal Co.; J. T. M. Stoneroad, president, Carnegie Coal Co.; T. J. Ward, secretary, Coal Distributors' Association: H. M. Wassum, vice-president, Henderson Coal Co.; F. G. West, general manager, Butler Consolidated Coal Co.; P. T. Fagan, employee representative.

District 3 (Northern West Virginia)—D. R. Buckley (chairman), Koppers Coal Co.; Samuel Pursglove (vice chairman), general manager, Pursglove Coal Mining Co.; C. W. Shinnamon (executive secretary): D. J. Carroll, president, Continental Coal Co.; Frank E. Christopher, president, Christopher Mining Co.; R. A. Courtney, president, Courtney Coal Co.; George D. Curtin, vice-president, Pardee & Curtin Lumber Co.; W. C. Dobbie, general superintendent, Jamison Coal Co.; William Findlay, Jr., general superintendent, Simpson Creek Collieries Co.; T. J. Johnson, president, Guston Run Mining Co.; Truman E. Johnson, vice-president, Hutchinson Coal Sales, Inc.; J. Howard Magee, sales manager, West Virginia Coal & Coke Corporation; Harry B. Martin, general manager, Miller-Todd Coal Co.; Charles W. Ream, president, Stanley Coal Co.; E. H. Reppert, president, Reppert Coal Co.; Louis Sitnek, president, Sitnek Fuel Co.; J. Noble Snider, vice-president, Consolidation Coal Co.; Frank Miley, employee representative.

District 4 (Ohio)—F. N. Barnes, president, Barnes Coal & Mining Co.; E. H. Davis, chairman of board, New York Coal Co.; William Emery, Jr., president, Cambridge Collieries Co.; Clifford Hawk, secretary, Hawk Coal Co.; J. F. Hillman, president, Industrial Coal & Iron Co.; S. B. Johnson, president, Lorain Coal & Dock Sales Co.; O. C. Larson, vice-president, North American Coal Corporation, Inc.; J. H. Miles, vice-president, Akron Coal Co.; J. C. Nelms, vice-president, Ohio & Pennsylvania Coal Co.; W. L. Robison, president, Youghiogheny & Ohio Coal Co.; George K. Smith, president, Sunday Creek Coal Co.; P. C. Sprague, vice-president in charge of sales, Hanna Coal Co.; Ezra Van Horn, executive vice-president, Ohio Coal Control Association; Whitney Warner, president, Warner Collieries Co.; E. S. Willard, general manager, United States Coal Co.; J. E. Young, vice-president, Massillon-Akron Coal Co.; John Owens, employee representative.

District 5 (Michigan)—H. W. Bean, sales manager, Robert Gage Coal Co.; Alex Jeffrey, president, Chippewa Coal Co.; Paul Begick, president, Monitor Coal Co.; G. C. Eastwood, vice-president, Consolidated Coal Co.; J. H. Mason, St. Charles & Garfield Coal Co.; W. E. Pippin, president, Saginaw Coal Mining Co.; John Hatton, employee representative.

District 6 (West Virginia Panhandle)—R. L. Berry (chairman), vice-president, Costanzo Coal Mining Co.; E. G. Mathiott (vice-chairman), vice-president, Valley Camp Coal Co.; R. J. Cotts (treasurer),

Coming Meetings

- Pocahontas Electrical and Mechanical Institute: third annual industrial exhibit, Aug. 19–21, Bluefield, W. Va.
- American Chemical Society: annual meeting, Sept. 6–10, Rochester, N. Y.
- West Virginia Coal Mining Institute: annual meeting, Oct. 1, Morgantown, W. Va.
- West Virginia Safety Day: mine-rescue meet and first-aid contest, Oct. 2, Mt. Hope, W. Va.
- Illinois Mineral Industries Conference: fifth annual meeting, Oct. 8 and 9, Urbana, Ill.
- Coal Producers' Association of Illinois: annual meeting, Oct. 12, Springfield, Ill.
- Northern Wyoming Coal Operators' Association: annual meeting, Oct. 15, Casper, Wyo.
- Coal Division, American Institute of Mining and Metallurgical Engineers: annual meeting, Oct. 27 and 28, William Penn Hotel, Pittsburgh, Pa.
- Illinois Mining Institute: annual meeting, Nov. 5, Hotel Abraham Lincoln, Springfield, Ill.

president, Hitchman Coal & Coke Co.; Matthew Bennett, proprietor, Clean Coal Co.; J. M. Connor, general superintendent, Windsor Power House Coal Co.; A. W. Dean, president, West Virginia-Pittsburgh Coal Co.; G. W. Savage, employee representative.

District 7 (Southern No. 1)—P. M. Snyder (chairman), Koppers Coal Co.; John J. Atwater, president, American Coal Co. of Allegany County; R. E. Brockman, president, Atlantic Smokeless Coal Co.; W. G. Caperton, president, Scotia Coal & Coke Co.; J. W. Carter, president, Carter Coal Co.; W. G. Crichton, Johnstown Coal & Coke Co.; O. M. Deyerle, president, F. at Top Fuel Co.; M. L. Garvey, Pocahontas Fuel Co.; J. A. Hunt, vice-president, Lillybrook Coal Co.; D. A. Newhall, vice-president, New River & Pocahontas Consolidated Coal Co.; S. S. Nicholls, vice-president, White Oak Coal Co.; E. C. Page, president, Crozer Coal & Coke Co.; R. D. Patterson, president, Weyanoke Coal & Coke Co.; W. A. Richards, president, Pemberton Coal & Coke Co.; R. E. Salvati, general manager, Island Creek Coal Co.; W. P. Tams, Jr., president, Gulf Smokeless Coal Co.; William Blizzard, employee representative.

District 8 (Southern No. 2)—Harry L. Gandy, chairman; L. E. Woods (vice-chairman), president, Crystal Block Mining Co.; D. D. Hull (vice-chairman), president, Virginia Iron, Coal & Coke Co.; Fred E. Gore (treasurer), vice-president, Blue Diamond Coal Co.; D. B. Cornett, president, Cornett-Lewis Coal Co.; W. J. Cunningham, president, Crummies Creek Coal Co.; Arthur Downing, general manager, Monitor Coal & Coke Co.; George P. Fitz, general manager, Ajax Coal Co.; J. D. Francis, president, Island Creek Coal Co.; R. H. Knode, president, General Coal Co.; Harry LaViers, general manager, South-East Coal Co.; A. F. Leckie, president, Leckie Coal Co.; E. C. Mahan, president, Southern Coal & Coke Co.; C. M. Moore, president, Moore Coal Co.; D. H. Morton, president, Winifrede Collieries Co.; M. L. Patton, vice-president, Truax-Traer Coal Co.; C. M. Watson, president, Elk Horn Coal Corporation; Samuel Caddy, employee representative; Wayne P. Ellis, secretary.

District 9 (Western Kentucky)—Brent Hart (chairman), president Hart Coal Corporation; J. D. Overall (secretary), general manager, Reinecke Coal Mining Co.; W. W. Bridges, president, Black Diamond Coal & Mining Co.; H. H. Coil, president, Coil Coal & Mining Co.; W. W. Crick, president, Truck Mine Association; Thomas M. Hill, treasurer, Providence Coal Mining Co.; Roger Holt, president, Blue Grass Coal Products Corporation; F. A. Hunter, president, Luzerne-Graham Mining Corporation; Justin Potter, president, Nashville Coal Co.; C. F. Richardson, president, West Kentucky Coal Co.; J. L. Rogers, president, Rogers Brothers Coal Co.; Douglas Ruckman, president, Duvin Coal Co.; J. H. Schneider, president, Dawson Daylight Coal Co.; L. J. Speed, sales manager, Beaver Dam Coal Co.; David D. Terhune, president, Empire Mining Co.; Paul Wickliffe, president, Greenville Coal Co.; E. J. Morgan, employee representative.

District 10 (Illinois)—George W. Reed, vice-president, Peabody Coal Co.; C. J. Sandoe, vice-president, Perry Coal Co.; Ray Edmundson, employee representative.

District 11 (Indiana)—Hugh B. Lee, (chairman), vice-president, Maumee Collieries Co.; W. M. Zeller (first vice-chairman), president, Knox Consolidated Coal Corporation; William H. Cooke (second vice-chairman), general attorney, Walter Bledsoe & Co.; Jonas Waffle (managing director-secretary-treasurer), managing director, Coal Trade Association of Indiana; W. R. Bootz, secretary, Crescent Coal Co.; George A. Enos, president, Enos Coal Mining Co.; Arch V. Grossman, vice-president, United Collieries, Inc.; George J. Leahy, vice-president, Little Betty Mining Corporation; B. E. Lundblad, vice-president, Central Indiana Coal Co.; F. S. Martin, Jr., vice-president, F. S. Martin & Co.; R. H. May, manager of sales, Sunlight Coal Co.; Earl Oliphant, general manager, Standard Coal Co.; Henry P. Smith, general manager, Princeton Mining Co.; R. E. Snoberger, vice-president, Binkley Mining Co.; C. N. Templeton, president, Templeton Coal Co.; W. J. Tipton, proprietor Tipton Coal Co.; W. Paul Zimmerman, president, Zimmerman Coal Co.; Frank Barnhart, employee representative.

District 12 (Iowa)—K. G. Carney, (chairman), secretary, Scandia Coal Co.; Joe Muelhaupt, Sr. (vice-chairman), president, Central Service Co.; S. V. Carpenter (treasurer), secretary-treasurer, Sunshine Coal Co.; William Abram, secretary, Colfax Coal Co.; Leonard D. Evans, president, Smoky Hollow Coal Co.; A. E. Hollingsworth, president, Central Iowa Fuel Co.; W. D. Johnson, president, Boone Coal, Inc.; M. B. McConville, secretary, McConville Coal Co.; W. O. Moore, attorney, representing truck-mine owners; E. O. Moss, president, Liberty Coal Co.; B. J. Powers, secretary-treasurer, Dallas Fuel Co.; Charles Riggen, proprietor, Riggen Coal Co.; Jacob Ritter, secretary, Old King Coal Co.; C. L. Rutherford, proprietor, Oskaloosa Coal Co.; J. D. Shuler, president, Shuler Coal Co.; W. W. Wilson, treasurer, Norwood-White Coal Co.; Frank Barnhart, employee representative; M. G. Youngquist, secretary.

District 13 (Southeastern)—Herbert S. Salmon (chairman), Salmon & Cowin, Inc.; W. C. Adams (vice-chairman), vice-president, Porter Coal Co.; W. F. Cobb, general manager, Galloway Coal Co.; R. T. Daniel, president, National Coal & Coke Co.; Henry T. DeBardeleben, president, DeBardeleben Coal Corporation; Prince DeBardeleben, vice-president, Alabama Fuel & Iron Co.; Stanlee Hampton, president, Whitwell Coal Co.; P. H. Haskell, Jr., vice-president, Alabama By-Products Corporation; A. R. Long, president, Brookside-Pratt Mining Co.; Carl McFarlin, president, Whitwell Coal Corporation; G. F. Peter, president, Southern Coal & Coke Co.; David Roberts, Jr., president, Brilliant Coal Co.; O. G. Robinson, president, Central Cahaba Coal Co.; B. F. Roden, president, Roden Coal Co.; D. A. Thomas, president, Montevallo Coal Mining Co.; William Mitch, employee representative; N. E. Cross, secretary-treasurer.

District 14 (Arkansas-Oklahoma)—Heber Denman (chairman), president, Paris Purity Coal Co.; George Reeves (vice-chairman), president, Excelsior Coal Co., Inc.; Earl Cobb (secretary-treasurer), president, Sans Bois Coal Co.; A. D. Clark, A. D. Clark Coal Co.; Earl Wells, president, Royal Smokeless Coal Co.; R. W. Winn, president, New Shockley Coal Co.; George Minmier, Jr., secretary-treasurer, New Superfuel Coal Co.; John McCurry, general superintendent, Bernice Anthracite Coal Co.; Pete Stewart, Jr., general superintendent, Stewart Coal Co.; H. W. Collier, president Collier-Dunlap Coal Co.; Horace Young, vice-president, R. A. Young & Son Coal Co.; Robert Boyd, Jr., president Boyd-Excelsior Fuel Co.; David Fowler, employee representative.

District 15 (Southwestern)—W. C. Shank (chairman), president, Crowe Coal Co.; E. M. Douthat (vice-chairman), president, Tebo Coal Co.; Ira Clemens, president, Commercial Fuel Co.; W. T. Edwards, vice-president and treasurer, Pocahontas producer Coal Co.; Hubert E. Howard, president, Binkley Mining Co. of Missouri; Leo G. Johnson, president, Western Fuel Co.; J. F. Klaner, president, Alston Coal Co.; Herman Kruger, proprietor, Kruger Coal Co.; George K. Mackie, Jr., vice-president, Clemens Coal Co.; J. C. Reighard, treasurer, Ol' Elliott Producers' Association; Earl A. Riley, secretary, Seneca Coal & Coke Co.; K. A. Spencer, vice-president, Pittsburg & Midway Coal Mining Co.; A. F. Paterson, president, McGennis Coal Co.; W. E. Widmer, president, Elmira Coal Co.; Henry Allai, employee representative; W. E. Blucher, secretary.

District 16 (Northern Colorado)—T. E. Jenkins (chairman), president, General Fuel Co.; James Brennan (vice-chairman), president, Imperial Coal Co.; Benjamin Bohlender, president, Bohlender Coal Co.; George Cowdery, president, Pluto Coal Mining Co.; H. B. Crandell, president, Clayton Coal Co.; Fred Foreman, superintendent, Shamrock Coal Co.; H. F. Nash, vice-president, Leyden Lignite Co.; F. R. Pool, vice-president, McNeil Coal Corporation; J. P. Peabody, president, Rocky Mountain Fuel Co.; Henry Richards, president, Eldorado Coal Co.; W. E. Russell, president, Wm. E. Russell Coal Co.; Carson W. Smith, president, Consolidated Coal & Coke Co.; F. W. Thurman, secretary-treasurer, Black Diamond Fuel Co.; William Wade, assistant treasurer, Golden Cycle Corporation; George Watson, proprietor, Domestic Coal Co.; O. F. Nigro, employee representative.

District 17 (Southern Colorado)—N. C. Anderson, general manager, Huerfano Coal Co.; G. C. Davis, manager, Stag Canon Branch, Phelps Dodge Corporation; George B. Dick, president, Jewell Collieries Corporation; W. H. Donovan, vice-president, Pryor Coal Mining Co.; D. L. Hansen, president, American Independent Coal Co.; H. H. Harris, vice-president, Hayden Coal Corporation; Moroni Heiner, president, Utah Fuel Co.; J. C. Larkin, sales manager, Swastika Fuel Co.; Douglas Millard, Colorado Fuel & Iron Corporation; H. E. MacDonald, president, Victor-American Fuel Co.; E. M. Oliver, general manager, Oliver Coal Co.; L. L. Patton; B. W. Snodgrass, president, Moffat Coal Co.; W. J. Thompson, sales manager, Harris Coal Co.; F. R. Wood, president, Temple Fuel Co.; Frank Hefferly, employee representative.

District 18 (New Mexico)—W. M. Boggess, sales manager, Gallup-American Coal Co.; W. C. Ferguson, president, Navajo Mercantile Co.; Sharp Hanson, president, Gallup Southwestern Coal Co.; P. D. Henderson, manager, Black Star Coal Co.; H. K. Hunt, sales manager, Mutual Coal Co.; V. R. McKnight, sales manager, Albuquerque & Cerrillos Coal Co.; George Miksch, general superintendent, Defiance Coal Co.; John Biava, owner, Biava Coal Co.; Rudolph Hefferly, employee representative.

District 19 (Wyoming)—T. J. O'Brien (chairman), president, Kemmerer Coal Co.; A. B. Foulger, Lion Coal Corporation; E. V. Kelly, manager, Buffalo-Wyoming Coal Co.; Eugene McAuliffe, president, Union Pacific Coal Co.; N. A. Swenson, president, Nugget Coal Co.; W. J. Thompson, president, Colony Coal Co.; R. J. Warriner, general manager, Owl Creek Co.; James Morgan, employee representative.

District 20 (Utah)—L. E. Adams, vice-president, Spring Canyon Coal Co.; F. J. Baker, F. S. Bulock, E. L. Cropper, treasurer, Chesterfield Coal Co.; R. N. Dalrymple; Moroni Heiner, president, Utah Fuel Co.; B. A. Howard, P. F. Keyser, president, Independent Coal & Coke Co.; Malcolm McKinnon; Carl Nyman, Maple Creek Coal Co.; E. K. Olson; Leroy Rigby; W. C. Stark, general manager, Blue Blaze Coal Co.; C. N. Sweet, president, Standard Coal Co.; L. R. Weber, president, Liberty Fuel Co.; G. W. Whipple; John M. Ross, labor representative.

District 22 (Montana)—F. V. H. Collins (chairman), president, Bair-Collins Co.; T. C. Russel (vice-chairman), general manager, coal department, Anaconda Copper Mining Co.; William Anderson, Anderson Coal Co.; E. C. Mattox, vice-president, Roundup Coal Mining Co.; W. A. Romek, Montana Coal & Iron Co.; H. A. Simmons, president, Eagle Coal Co.; Joseph Hunter, employee representative.

District 23 (Washington)—Charles F. Larrabee (chairman), president, Roslyn Cascade Coal Co.; William Strain (first vice-chairman), proprietor, Strain Coal Co.; Richard Francis (second vice-chairman), employee representative; Fred Bianco, proprietor, Bianco Coal Mines; James Bagley, president, Bucoda Coal Mining Co.; George Watkin Evans, general manager, Wilkeson Coal & Coke Co.; James H. Flanagan; George Littlefield, general manager, Cedar Mountain Mines; Edward F. Medley; Harry Merbach, sales manager, Bellingham Coal Mines; N. D. Moore, president, Pacific Coast Coal Co.; John H. Morris; J. G. Parkin; George Rockefeller; William C. Shaw; John I. Springer, vice-president, Dale Coal Co.; D. S. Hanley (secretary-treasurer), vice-president, Pacific Coast Coal Co.

IMPOSE HEAVY PENALTY FOR COERCION IN BRITAIN

THE BRITISH do not temporize with coercion. Michael Kane, chairman of a local branch of the Nottingham Miners' Association, was sentenced to two years' imprisonment at hard labor for attempting to intimidate workers at the Harworth mine. He was shown to have boarded a bus carrying men to work and to have threatened to overturn the bus if the men returned to work the following day. Attempts also were made to intimidate the wives of workers who refused to strike. Ten others were sentenced with Kane for varying terms.

★ ★

Anthracite Regulation Bills Introduced in Congress

Senator Guffey and Representative Boland, both of Pennsylvania introduced a bill in Congress to regulate the anthracite industry on July 15. The measure is almost identical with the Guffey-Vinson Bituminous Coal Act. It provides for a commission of five, two to be experienced anthracite mine workers, two experienced producers, and one without previous experience in the industry. A Consumers' Counsel also is provided for, and the tax is the same, 1c, per ton, with the proviso that the tax shall not apply to coal consumed by the producer.

A code is to be promulgated, with a penalty tax of 19½ per cent for those who do not become code members; a district board is to be created; statistical bureau set up; unfair methods of competition set forth about the same as in the bituminous act; provision made for court review orders, etc.; the labor provisions are the same; penalties for failure to comply with orders and other duties of the Commission are similar, as the Commission is authorized to participate in freight-rate cases, look into safety methods, and generally take action to conserve anthracite reserves. With respect to anthracite reserves, there also is a Title II, which provides that any owner of such coal land desiring to convey it to the United States shall submit an offer to the Secretary of the Interior in order that it may be purchased by the government if arrangements can be worked out satisfactorily.

The act is designed to take effect 60 days after its enactment and to have a life of four years from the date of its approval.

Governor Earle of Pennsylvania has called a conference for Sept. 28 to discuss bootleg mining.

Old Timers Hold Reunion

A parade, banquet, field sports for men and women, and entertainment featured the thirteenth annual reunion of the Union Pacific Old Timers' Association, held June 19 at Rock Springs, Wyo. The parade, which followed the business meeting, included the famous McAuliffe Kiltie band and brass bands from Reliance-Winton, Rock Springs and Hanna.

Nearly 800 took part in the annual banquet, with I. N. Bayless, assistant general manager, as toastmaster. Addresses were made by President McAuliffe, Vice-President Pryde and Dr. L. E. Young, vice-president, Pittsburgh Coal Co. Forty-year gold service buttons were presented by Mr. McAuliffe to Mr. Pryde, Gust Ojala and Fred Wall.

At the first-aid meet, which preceded the reunion, 26 teams took part. The team from Superior D took top honors with 497⅞ points out of a possible 500; Reliance was second, with 497; and Superior B took third, with 496⅛. Superior boy scouts led their division, with 499⅛; senior girl scouts from Hanna topped their class, with 498, and junior girl scouts from Superior were winners with 499⅛.

Rate Complaint Dismissed

The Interstate Commerce Commission at Washington dismissed on June 25 a complaint by the Pennsylvania Coal & Coke Corporation against rail freight rates on coal to New York harbor for water shipment to New England. The company charged that the rates from Pennsylvania to New York—$2.67 per ton to the lower piers and $2.72 to the upper piers—were too high and the rates from the smokeless fields to Hampton Roads—$2.52—were too low. The New York rates include dumping the coal into vessels, however, whereas at Hampton Roads there is an additional charge of 5c a ton for dumping.

Koppers Mine Wins Trophy

In recognition of an outstanding record for safety, the "Sentinels of Safety" trophy for 1936 for the bituminous coal mine group has been awarded by the U. S. Bureau of Mines to the Coxton mine of the Koppers Coal Co., Coxton, Ky. The mine operated 274 days, working 339,156 man-hours, last year without a lost-time accident. Among anthracite producers, the Raven Run mine of the Hazle Brook Coal Co., Raven Run, Pa., was the winner, working 447,360 man-hours, with an accident severity rate of 1.473. Honorable mention was given to the following bituminous mines: Rockhill No. 7 mine, Rockhill Coal & Iron Co., Robertsdale, Pa.; Reliance No. 1, Reliance, Wyo., and Hanna No. 4, Hanna, Wyo., both operated by the Union Pacific Coal Co.; Moween mine, Keystone Coal Co., Moween, Pa. Three of the mines operated during the contest year without a lost-time injury. The trophy is donated annually by the *Explosives Engineer*.

Vetoes Dewatering Bill

The Powell bill to appropriate $50,000 for the purchase of mine pumps to be used to remove flood waters from Sahara No. 3 mine of the Sahara Coal Co., at Harrisburg, Ill., was vetoed July 10 by Governor Horner at Springfield. In his message accompanying the veto, however, the executive pointed out that a $500,000 appropriation had been made for flood relief and indicated—without giving his approval—that enough of the sum remains to purchase the pumps. Four days later the State Department of Mines and Minerals rushed specifications for pumps to dewater the flooded workings. Fifty thousand dollars was earmarked for the equipment shortly after Governor Horner vetoed the Powell bill.

New Automatic Heat Units Make Their Debut

New automatic heat units have been introduced by Fairbanks, Morse & Co., Burnham Boiler Corporation, Fitzgibbons Boiler Co. and Anchor Stove & Range Co. Two of the units are specially designed for use with anthracite.

The new Fairbanks-Morse coal burner, for use with anthracite, is built in sizes consuming 20, 30 and 40 lb. of coal per hour, models being available in hopper-spill types with and without ash remover and in bin-feed types with ash remover. An outstanding feature is the "Fire-Trol," which is not only a constant air-volume regulator but automatically reduces the quantity of air supplied as the fuel bed becomes thinner and increases it as the fuel bed increases in thickness and density.

The "Anthra-Heat" unit, manufactured by the Burnham Boiler Corporation and the Fitzgibbons Boiler Co., also is, as its name implies, designed for hard-coal consumption in heating by steam, vapor or hot water. With combustion space and fire door entirely eliminated, and fitted with a flat spiral rotary grate of solid design, this burner marks a departure in heaters for small homes. Enough fuel can be stored in the unit itself for 24 to 48 hours—it is charged with 290 lb. of coal, and semi-automatic operation is achieved through the natural fall of fresh fuel. This heater was developed in the laboratories of Anthracite Industries, Inc., especially for small, low-cost homes.

The Anchor Stove & Range Co. announces two new units: the Anchor Kolstoker heating system and the Anchor Kolstoker Fire Chief. The first named is of heavy cast-iron construction with asbestos lining, has fire-bowl sections nearly an inch thick, and extra deep grooved joints between sections and side bearing surfaces to prevent leaks; also high combustion chamber and self-cleaning radiator. The furnace has a removable plate so that a fan and filter unit can be installed, and a special coil is available for hot water in warm weather. The Fire Chief stoker is a cabinet type for use in small homes or bungalows; it can be taken down, moved and reinstalled as easily as a refrigerator.

To Reopen Barbour Mine

Bids of the Black Hills Land & Cattle Co. on Alamo No. 2 mine, formerly operated by the Barbour Coal Co., and of the Willets interests, of New York, on the properties of the Alamo Coal Co., both in Huerfano County, Colorado, having been confirmed by federal court, it has been definitely decided that the first-named mine will be reopened for operation this autumn. George Dick is to be manager of operations and Frank Whiteside, chief engineer, Victor-American Fuel Co., has been retained as technical adviser.

Mine Inspectors' Institute Examines Accident-Reduction Approaches

SAFETY from five major avenues of approach was the theme of the program of the 28th annual convention of the Mine Inspectors' Institute of America, held June 21-23 at the Deshler-Wallick Hotel, Columbus, Ohio. The first approach to accident-prevention was through ventilation. Classification of mines on the basis of their methane content was another. How to protect workers from roof falls in mechanical mining was a third. Education and more frequent inspections were the other avenues explored. The ventilation approach was a three-way one which included sprinkling and dilution of toxic gases as well as ventilation in its more general aspects. Experiences in Illinois, Ohio, Pennsylvania and West Virginia were drawn upon for the mechanical mining symposium.

Oxygen Deficiency Important

Ventilation, stated H. G. Houtz, inspector at large, West Virginia Department of Mines, is inadequate unless it provides complete protection against atmospheres which are deficient in oxygen or contain poisonous gases or explosive mixtures. Oxygen deficiencies, particularly when accompanied by an increase in carbon dioxide, throw an added strain on the lungs and contribute to "the high rate of pulmonary ailments among the older miners." Moreover, comparisons between operations known to have poor ventilation and others of the same class with adequate ventilation "show that the poorly ventilated mines have a decidedly reduced efficiency." Workers in such operations are listless.

Atmospheres deficient in oxygen also are "more or less likely to contain poisonous or other dangerous gases." Poisonous gases liberated in blasting or formed by natural conditions are dissipated slowly in confined areas. Their presence frequently is unsuspected either because the worker acquires a partial immunity or because their immediate effects, such as headaches, usually are attributed to some alien physical ailment. Mr. Houtz cited one case where miners had been working in the presence of small quantities of carbon monoxide without realizing the injurious effects, although their blood showed a 30 per cent saturation. In another case, where artificial respiration was necessary to revive a miner, investigation disclosed that the men had been exposed daily to 0.10 to 0.15 per cent of carbon monoxide "for a considerable length of time after shooting."

While hydrogen sulphide is not common, cases are known where feeders liberate this gas in dangerous quantities. In one such mine, remarked Mr. Houtz, as much as 0.04 per cent was found at the face. Since the danger from all these gases is greatly increased in stagnant atmospheres, a continuous, adequate current of air to all parts of the mine is essential. "In an effort to provide the proper protection, the West Virginia Department of Mines has ruled that air containing less than 20 per cent of oxygen is below standard and that not less than 8,000 cu.ft. of air per minute be delivered continuously to within a reasonable distance of the working faces."

Too frequently, asserted the speaker, little thought is given ventilation requirements in projections for development. The fan cannot be expected to do the whole job. There must be sufficient airways and they must be kept

Richard Maize
President-Elect, Mine Inspectors' Institute

clean. Prohibiting the use of single doors and providing enough aircourses so that the haulage roads are adequately air-locked at all times will do much to minimize the possibilities of explosions. Better stoppings, too, are needed; the cumulative losses from a small leak here and there cannot be ignored. If, because of leaky stoppings, four to twenty times as much power is used to insure adequate ventilation as is theoretically needed, savings in power costs alone would pay for stoppings such as would prevent these unnecessary air leakages.

There is no comparison, bluntly declared John V. McKenna, Pennsylvania State mine inspector, Waynesburg, Pa., between the quantity of noticeable coal dust in suspension or deposited on the floor or the sides of haulageways in mines using sprinkling systems at the face and operations which do not. Inasmuch as 95 per cent of the dust is raised at the face during cutting and loading, it is plain that the quantity in aircourses and haulageways will "be very materially reduced when the dust is thoroughly wetted and kept down at the point it is raised." Efficiency also is increased because the air breathed is cooler and less dusty.

Pennsylvania bituminous operations which sprinkle at the face bring in the water through boreholes which are fed from storage tanks or tap a near-by stream. Mine water too high in acidity, he explained, should not be used because it will increase the cost of the system by requiring more frequent replacement of pipe lines. Tapping a stream by digging a ditch from the stream to the borehole, of course, is less costly, as neither pumping, extra pumps nor storage tanks are needed.

In a typical installation described by Mr. McKenna, 4-in. pipe lines take the water from the bottom of the borehole through the main entries; 2-in. lines carry it into the producing entries and a 1-in. line delivers the water to the working face, usually under pressures of 40 to 100 lb. per square inch. A 25- to 50-ft. hose is attached to the end of the 1-in. pipe in each place and the flow of water is controlled by a valve operated by the miner. Each mining and loading machine has two water connections and a hose attachment to spray the dust continuously from both sides while the machines are running.

Sprinkling Betters Light

Prior to installing sprinkling systems, lights of a top-cutting machine could not be seen from distances 30 to 60 ft.; after installation, it was possible to see the lights from the entry when the cutter was operating at the face of a 250-ft. room. Because sprinkling leaves the dust damp after cutting, continued Mr. McKenna, it is possible to shoot down the place "without fear of throwing a cloud of dust into the air or a blown-out shot igniting the dust." After shooting and before loading, the miner thoroughly wets the cuttings again as well as face, roof, ribs and floor from 30 to 40 ft. outby the face. When digging out a shothole, the hose is placed into the top of the cut, letting the water run as long as the miner is digging. Cars are sprinkled when loading is completed and again before being pulled out of the working place. Some mines also sprinkle trips at certain points along the haulageway and at the dumping point; empties, too, sometimes are sprinkled as they are taken into the mine. Sprinkling costs (including material and labor) run from 1.0 to 1.6c. per ton.

All industrial explosives produce toxic gases when detonated, said S. P. Howell, explosives engineer, U. S. Bureau of Mines. From a practical safety standpoint, carbon monoxide, hydrogen sulphide and oxides of nitrogen are the major concern in coal blasting. The first two named are asphyxiants; the nitrogen oxides are irritants and the most toxic. Physiological response to various concentrations of these gases is summarized in Table I. Adequate ventilation to dilute these gases below the dangerous concentration points is the major protection against toxic fumes. Certainty of adequate dilution

Table I—Physiological Response to Various Concentrations of Toxic Gases

Gas	Specific Gravity	Kills in Very Short Time	Dangerous for ½ to 1 Hr. Exposure	Maximum Concentration for Exposure of ½ to 1 Hr.	Amounts Causing Slight Symptoms After Several Hours of Exposure	Maximum Allowable Concentration for Prolonged Exposure
		Concentrations in Parts Per Million				
Carbon monoxide	0.9671	4000	1500–2000	600–700	500	100
Hydrogen sulphide	1.190	420–600	360–500	200–300	100–150	85–130
Nitrogen tetroside	1.6–3.2	320–530	117–154	105–210	50	39

can be assured only by the use of carbon monoxide and hydrogen sulphide detectors, "which respond promptly, or sampling and analyzing the gases, which gives more complete information regarding the proportions of all gases, but is time consuming."

When the ventilation is reasonably good and the men need not return to the face too quickly, Mr. Howell thought not more than 0.32 cu.ft. per pound (as determined by Bichel gage tests) "a not unreasonable limit to place on the toxic gases which are produced by industrial explosives for use in rock blasting and tunnels. For blasting when the quantity per hole or per round is limited—single shots in coal mines, or a few shots, especially where the working faces are well ventilated—the limit need not be nearly so low."

Danger From Bunching Miners

Obviously, he continued, the quantity of toxic, or other, gas produced per round varies as the quantity of explosive per round. "The increase in concentrated mining often means larger quantities of explosives per blast, usually a much greater quantity of explosives used per day per working place and an urge to return to the place of the blast very promptly after the blast." Improved ventilation, therefore, becomes still more important; return of the men to the place of the blast after firing should be prohibited until an adequate time interval has elapsed. Under these conditions, only explosives producing the smallest quantity of carbon monoxide should be employed. Class B or C permissibles (see Table II) should never be used.

Stemming and electric firing, stated the author's formal paper, abstracted in presentation, both contribute considerably to the reduction of toxic gases. Burning of explosives is promoted when deteriorated or aged explosives are used. Explosives purchases should be limited to quantities which can be used promptly and the material should be stored in dry, cool magazines with inside temperatures not exceeding 85 to 86 deg. F. The Bureau of Mines type of cement-mortar magazine was recommended. In floor discussion with Prof. H. E. Nold, Ohio State University, it was brought out that use of a special aluminum bronze paint reduced magazine temperatures 5 to 8 deg.

Because the volume of methane gas varies so much at different points throughout the anthracite region, explained P. J. Friel, State mine inspector, Shamokin, Pa., the minimum safeguards necessary in highly gaseous sections would go far beyond what "would be considered as reasonable, practicable safeguards in other parts of the region." Some mines, for example, have been worked for more than a century without a fatality chargeable to a gas explosion, whereas in one inspection district (see Fig. 1) the daily generation of methane has reached 17,870,000 cu.ft.

A definite attempt, therefore, was made this year to classify operations on the basis of explosive gas evolved. This classification, embodied in an anthracite mining code rejected by the Legislature, provided that all anthracite mines or sections thereof should be classed as "A," "B," or "C," dependent upon the quantity of combustible gas found. The percentage of combustible gas for each class was: Class "A" (nongaseous), 0.07 per cent or less; Class "B," more than 0.07 and less than 0.50 per cent; Class "C," more than 0.50 per cent.

Examinations to determine classification were to be made semi-annually by the operator at the faces of the first and last working places on a split "and the averages of the test shall be the determining factor." Ventilation must have been stopped at least fifteen minutes prior to the examination. "No mine or section thereof shall be considered as belonging to a less hazardous class than the one to which it formerly belonged without permission from the mine inspector of the district." A separate set of regulations governing the use of electricity in each class was provided.

Classification Failed to Pass

The proposed classification, said S. J. Phillips, State mine inspector, Scranton, Pa., places a premium on good ventilation, since such ventilation may make possible changing the ratings of Class "C" mines to Class "B" and Class "B" operations to Class "A." Classification also would encourage intensive supervision where most needed and obviate expenditures for unnecessary safeguards in mines free from gas hazards. Although operators and union officials objected to some features of the proposed code, these groups, declared Mr. Phillips, did not "gang up" on the classification plan.

Advocates of changes in the bituminous mining provisions of the State were more successful. These changes were detailed by F. W. Howarth, State mine inspector, Republic, Pa. Mine inspectors now may require weekly determination of the methane content of ventilating currents "on the return end of the air current or currents just beyond the last working place, unless otherwise directed by the inspector." The electrical code is to be made mandatory. A gaseous portion of a mine under this code is defined as "all the workings and roadways traversed by the locomotive and ventilated by the same continuous air current and in which portion explosive gas has been generated in sufficient quantity to be detected by an approved safety lamp within a period of two years."

All trolley locomotives operated from a trolley wire, Mr. Howarth pointed out, are excluded from such gaseous sections unless: (1) There is no accumulation of explosive gas at any point in the section; (2) the methane content of the air current in which the locomotive operates does not exceed 0.5 per cent; (3) the air current is fully controlled by air locks or otherwise. Unless the time is extended by the Secretary of Mines, the new regulations also outlaw all open-type electrical equipment in working places in a gaseous section of a mine in a year after enactment of the law. Use of main return airways as haulageways for trolley locomotives in gaseous mines is prohibited.

Determination of methane content, emphasized P. J. Callaghan, State mine inspector, Bridgeville, Pa., must be made in any split or at any point in the split the inspector may designate. Trolley locomotives in entries in gaseous mines, he said, were comparable to open lights. The 1911 law, he added, needed the clarifications the present revisions will bring. But, to have the proper margin of safety, the methane

Table II—Quantity of Toxic Gases (CO and H_2S) From One Pound of Different Industrial Explosives

Class and grade of explosives	Cubic feet per pound (average) of toxic gases
Black blasting powder[1]	1.03
Permissible explosives	
Class A	
Minimum	.00
Maximum	1.25
Class B	
Minimum	1.25
Maximum	2.50
Class C	
Minimum	2.50
Maximum	3.72
20 per cent:	
Gelatin[2]	.13
Ammonia	.56
Straight	.63
30 per cent:	
Ammonia gelatin	.13
Gelatin	.16
Ammonia	.47
Straight	.65
40 per cent:	
Ammonia gelatin	.18
Gelatin	.25
Ammonia	.67
Straight	1.19
50 per cent:	
Ammonia gelatin	.13
Gelatin	.28
Ammonia	.86
Straight	1.96
60 per cent:	
Ammonia gelatin	.20
Gelatin	.35
Ammonia	.93
Straight	3.16
80 per cent:	
Ammonia gelatin	.29
Gelatin	1.88
100 per cent:[3]	1.69

[1] 1½ lb. black blasting powder produces 1.55 and 2 lb. of black blasting powder produces 2.06 cu. ft. of toxic gases.
[2] One gas sample contained 0.08 cu.ft. per pound of explosive.
[3] Blasting gelatin.

content must be kept below 0.5 per cent.

Insufficient timbering and failure to make frequent and proper examinations of roof and coal face, conceded James McSherry, director, Illinois Department of Mines and Minerals, undoubtedly are the underlying causes of most accidents from falls. But, he insisted in a paper read by M. K. Herrington, secretary to the director, "there are several other factors we should consider which will make for better roof and face control and fewer accidents from falls." Face bosses and loading-machine crews place too much reliance on examiners' marks. Too often rooms may not be sufficiently narrowed down when bad top is encountered. Occasionally a disposition "to shoot for peak production too soon after machine installations are made" shortens the transition period from hand to mechanical loading too sharply.

Use of blasting agents which reduce the shattering effect on roof and coal was commended because such agents "should have a tendency to reduce accidents from falls." Mr. McSherry also favored limiting the number of loading machines under the jurisdiction of a face boss. "I know of few, if any, cases in Illinois where conditions are such that a face boss can do justice to his job and have more than one machine under his jurisdiction, and at the outside two, if the units are small." Machine operators should be selected with particular care and trained as key men on their crews.

Machine Loading Made Safe

In the six years ended Dec. 31, 1936, the Hanna Coal Co., stated Jerome Watson, company mine inspector, has loaded 3,002,052 tons mechanically "without a lost-time accident from roof falls while loading." The roof consists of approximately 10 ft. of soft shale or soapstone with 1 to 2 ft. of rooster coal and falls very readily when not supported by posts or timbers. This safety record "was made possible by close supervision, maintaining adequate and uniform pillar systems, rigid enforcement of standard method of posting, frequent and systematic mine inspection and continual educational safety programs."

Posting standards call for two rows on each side of the roadway. Track is laid to center line. Road or track posts are set 3 ft. apart; gob posts are set 6 ft. apart and 18 in. toward the rib line and staggered with the road posts. Right rail or road posts are set to give a minimum clearance of 14 in. over all mobile track equipment. Places are driven narrow (approximately 12 ft.) and timbered when roof is weak with crosspieces 4 to 8 ft. apart, depending on the character of the roof. Each working place is examined regularly once every 30 days by company mine inspectors to see that standard safety provisions are observed.

Fewer accidents from roof falls should occur with loading machines and conveyors when proper timbering systems and adequate roof inspection are maintained, asserted P. J. McGraw, district mine inspector, West Virginia Department of Mines. Unfortunately, when the machines were first introduced major emphasis was placed on tonnage, "while timbering and other safety factors" were overlooked. Hand-loading timbering standards were continued and a number of serious accidents to machine operators resulted. Adoption of timbering standards for the northern part of the State now is under consideration.

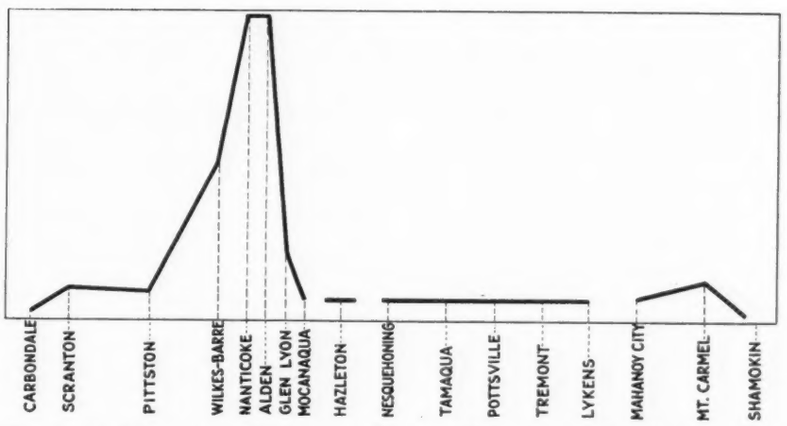

Fig. 1—Variations in methane generation in different parts of anthracite region

"The only satisfactory method of timbering working places where loading machines are used," said Mr. McGraw, "is a system of crossbars. These crossbars should be set on 5-ft. centers and supported on legs set into or very close to the rib. These legs may be posts or mechanical jacks of various designs. The bars may be taken down and moved ahead as the machine advances. The permanent timber behind the machine may be either permanent crossbars or posts."

Tender drawslate and roof, stated William Lauder, assistant production manager, Pittsburgh Coal Co., in closing the formal discussion on protecting workers from roof falls in mechanical mining, demand close timbering. In some mines the roof is further supported by 12 to 18 in. of top coal. When top coal is left in the Pittsburgh district, room width must be narrowed to at least 14 ft. and a row of posts on 3- to 4-ft. centers placed on each side of the roadway. Moreover, if faults are encountered in the roof, crossbars set on 4-ft. centers are used the entire distance the fault runs as well as a short distance outby and inby of the fault. Setting a crossbar at the working face in all mechanical mining where top coal is left was recommended.

These standards, he explained, had particular reference to operations with tractor-type loading equipment. Crossbars on 4-ft. centers, however, also should be used in the case of slips and defects in mines with track-type loaders. When roof conditions are good, working places not over 21 ft. wide and two rows of posts are used, the gob row should be set on 4-ft. centers 9 ft. from the rib and 10 ft. from the active working face; the second row should be set along the roadway on 3-ft. centers 12 ft. from the face and 9½ ft. from the roadway rib. This gives ample clearance along the roadway.

Safety posts or roof jacks, continued Mr. Lauder, should be set temporarily between the rows of permanent posts and the face and be moved and reset as the loader advances. With tender roof, it may be necessary to cut down the room width and use additional crossbars. When pillars are worked open-ended with a small fender next to the fall, posts should be set on 2-ft. centers along the fender to support the roof and prevent the gob from pushing out the fender.

In case the drawslate cannot be supported by forepoling, snubbing holes should be fired and coal loaded, then the center breast hole fired and the coal loaded out. This procedure, explained Mr. Lauder, "will enable the crew to set post or mechanical slate jack for protection, with cap-pieces of sufficient length and adequate thickness for the setting of two posts or mechanical slate jacks under the one cap-piece to allow for the removal of one and yet support the drawslate with safety. Then one of the butt shots are fired and loaded out, and the slate is protected by additional posts and caps and continued in the same way until the cut is loaded out. Posts and jacks are then removed to drop the drawslate and proceed with the gobbing."

The system of mining, adequate timbering, well selected and trained workers and effective supervision are essential to safe conveyor mining. Pittsburgh Coal Co. is using a full retreat system with butt entries 2,000 ft. long and 300-ft. centers between each pair of butts. Rooms are turned on 72-ft. centers and are driven 15 ft. wide. Slate in rooms and ribs varies from a few inches to 9 ft. in thickness. All drawslate in rooms and pillars is crossbarred with 4x6x120-in. oak timbers set on 3-ft. centers. In addition to three posts under each bar, a row of posts also is set on the gob side of rooms and crosscuts.

Posts or jacks are used as coal is loaded out at the face until there is room to set another crossbar. When

pillar drawing starts, a place 15 ft. wide is driven across the pillar, leaving a 5-ft. fender between the gob and this cut-over. The same timbering as in rooms is used after the cut-over is finished, leaving about a 2-ft. fender for protection against the outby adjoining pillar, "which should be approximately 50 ft. in advance." When the cut-over is completed and conditions permit, the pillar is slabbed by the open-end method. If the 5-ft. fender begins to show excessive weight, a fall is made to reduce the pressure on the face.

Wyoming, with approximately 97½ per cent of its output mechanically mined, had 263 non-fatal accidents with a production of 6,000,000 tons. Colorado, added Thomas Allen, chief mine inspector for that State, mined only 7½ per cent of its output mechanically but had 1,163 non-fatal accidents for 7,000,000 tons. Under the present Colorado law, he explained, no mechanical device can be introduced into any mine in that State except under such conditions as the chief mine inspector may prescribe. Pussyfooting would not make mining safe; the mailed fist in the silken glove was needed, in his opinion.

Education to make men think in terms of safety, declared Thomas P. Kearns, superintendent, Division of Safety and Hygiene, Industrial Commission of Ohio, must supplement regulatory requirements if accidents are to be cut to a minimum. When no organization exists to carry on this work, the mine inspector must add the educational program to his regular duties. Once tolerated, the visits of mine inspectors now are welcomed by progressive management. Education has created this more friendly atmosphere.

Safety Is Money in Pocket

What does accident prevention mean in dollars and cents? As a result of several years' intensive safety work, said Mr. Kearns, one small group of companies mining 3,100,000 tons of coal in 1932 received credit ratings which reduced its compensation premiums $24,000; last year this same group, mining 7,600,000 tons, saved $330,000 through credit ratings. Compensation costs for this group approximated $34,300 per million tons; a second group, with a less favorable record, paid $105,900. But, important as the financial gains are, the greatest incentive must and should be humanitarian—the saving of human lives, which cannot be valued in dollars and cents.

The humanitarian side also was stressed by Lot H. Jenkins, district mine inspector, Martins Ferry, Ohio. Turning to the financial aspects, he stated that one eastern Ohio company which in 1931 paid a rate of $9.82 per $100 of payroll now pays $3.32 as a result of an active safety program. Another company which paid the basic rate of $7.50 for compensation insurance in 1932, during the last half of 1936 had a rate of $3.59 against a basic manual rate of $7.00. Real improvement, however, is possible only when top management is thoroughly sold and the spirit of accident prevention is carried all the way down the line.

Presenting an over-all picture of the value of more frequent mine inspections in reducing accidents, Frank T. Powers, district mine inspector, Frostburg, Md., pointed out that from 1907 to 1922 inclusive the fatality rate in Maryland was 3.21 per 1,000,000 tons. In 1922 more inspectors were employed and new mining laws became effective. Despite increasing difficulties in mining conditions, with second and third mining common, the 1922-36 rate dropped to 2.90. It is not enough, however, for State mine inspectors to make recommendations and criticisms in their periodical inspections. Mining companies should employ inspectors and engineers "to supervise and direct all safety work and have it in such shape that a visit from an inspector, federal or State, would be a pleasure rather than a tragedy."

That statement, remarked J. F. Bryson, safety director, Harlan County Coal Operators' Association, is "the meat of the whole paper." While taking issue with Mr. Allen on the mailed fist, Mr. Bryson did feel that there should be more whole-hearted cooperation between operators and State mine inspectors. Periodical inspections have reduced accidents in Kentucky; in one section producing 15,000,000 tons annually fatalities dropped from 50 in 1928 to 14 in 1933. Unfortunately, since 1934 the State inspection force has been cut from ten to two full-time men while 1,300 wagon mines have been added to the total to be inspected. This curtailment in inspection personnel already has been reflected in accident rates.

In line with resolutions passed by a number of mining organizations, the institute also went on record protesting reductions in appropriations for the work of the U. S. Bureau of Mines. A second resolution requested the Bureau to seek funds for training mine-rescue crews. In discussions preceding the presentation of this resolution it was pointed out that the great decrease in mine explosions in recent years had made it difficult for new men to acquire experience with breathing apparatus under actual fire and explosion conditions. Following proposals made at the Denver meeting last year an appeal had been made to the Bureau to undertake this work at Bruceton, where explosions and fires could be staged, and tentative plans for financing such training had been outlined.

The 1938 meeting will be held in Springfield, Ill.

Mine Inspectors' Leaders

• Richard Maize, district mine inspector, Uniontown, Pa., was elected president of the Mine Inspectors' Institute of America at the 28th annual convention of that organization, in Columbus, Ohio, last month. Mr. Maize, who was vice-president, succeeds James Berry, chief, Ohio Division of Mines.

J. J. Rutledge, chief mine engineer, Maryland Bureau of Mines, Baltimore, was advanced from second to first vice-president and also reelected treasurer. Thomas Allen, chief inspector of coal mines, Denver, Colo., moved up to the second vice-presidency, and James McSherry, director, Illinois Department of Mines and Minerals, Springfield, was made third vice-president.

C. A. McDowell, personnel director, Pittsburgh Coal Co., Pittsburgh, Pa., was reelected secretary, and J. J. Forbes, supervising engineer, safety division, U. S. Bureau of Mines, Pittsburgh, was again chosen as assistant secretary. James W. Paul, mining engineer, Pittsburgh, was renamed editor in chief for the institute and R. Dawson Hall, engineering editor, *Coal Age*, publicity editor.

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Pagnotti Leases Mine

No. 9 colliery of the Pittston Co., at Pittston, Pa., has been leased by the Sullivan Trail Coal Co., headed by Louis Pagnotti, and maintenance men have been put to work clearing up and relaying tracks preparatory to reopening. Plans are being prepared for the erection of a new steel breaker, 72x90 ft. and 115 ft. high, which is expected to be ready for operation about Dec. 1.

New Preparation Facilities

DeAngelis Coal Co., Inc., Jessup, Pa.: Contract placed with Chance Coal Cleaner for 12-ft.-diameter Chance cone to clean egg to buckwheat inclusive; capacity, 150 tons per hour; installation completed.

Maumee Collieries Co., Terre Haute, Ind.: Contract placed with McNally-Pittsburg Manufacturing Corporation for washing plant to be equipped with McNally-Pittsburg dewatering screens and settling cone to clean and classify coal into five sizes; capacity, 250 tons of 4x0-in. coal per hour; to be completed about Oct. 1.

Moffat Coal Co., Taylor Colliery, Taylor, Pa.: Contract placed with Finch Manufacturing Co. for 10-ft. Menzies cone separator to clean buckwheat and rice sizes of coal; feed capacity, 110 tons per hour.

Raven Red Ash Coal Co., Raven, Va.: Contract placed with Jeffrey Manufacturing Co. for addition of washing plant to present tipple, equipment to include a Jeffrey self-contained unit washer complete with diaphragm jig, water circulating and clarifying system, dewatering screen, and raw and washed-coal and refuse conveyor; capacity, 60 tons per hour.

Sullivan Trail Coal Co., West Pittston, Pa.: Contract placed with Finch Manufacturing Co. for 12-ft. Menzies cone separator to clean egg and stove coal; feed capacity, 160 tons per hour.

Nova Scotia Mining Society Descants On Mine Fires and Forecasts

A HALF CENTURY of activity was celebrated by the Mining Society of Nova Scotia by a meeting and visits in and around Halifax, June 22-23, followed by trips from Sydney on June 25 to No. 1B colliery, Glace Bay, and the Sydney steel plant. How mine fires occur and are combated in the Pictou field; how difficult, costly and hampering conditions should be guarded against by forecasting, the nature of mine and boiler waters and their treatment, with papers on gold, nickeliferous pyrrhotite, zinc, lead and copper, aroused much discussion at the several well-attended sessions.

After an address of welcome by Walter Mitchell, Mayor of Halifax, with N. T. Avard, president, in the chair, J. L. Bowlby, analytical engineer, Dominion Steel & Coal Co., outlined that company's practices in dealing with mine and boiler waters and detailed the progress made during the past year, substantiating earlier forecasts. At the luncheon, Harry Piers, curator, Provincial Museum, Halifax, who presided, described the origin of the society, tracing it to the Gold Miners' Club of Nova Scotia, organized in March, 1887, and reorganized as the Gold Miners' Association of Nova Scotia, March 3, 1888. On March 30, 1892, the latter association dissolved to form, with the Coal Owners' Association of Cape Breton and Pictou Counties, the present society, which in 1896 joined with the Federated Canadian Mining Institute, then newly formed, only to become independent again in March, 1898, but to join with the Canadian Mining Institute (now the Canadian Institute of Mining and Metallurgy) in May, 1918. In that amalgamation its identity nevertheless was preserved.

Where to Place Fire Seals

For mines free from gas, seals to control mine fires should be built as close to the fire as possible, said H. C. M. Gordon, assistant to the general manager, Dominion Steel & Coal Corporation, Stellarton, N. S., at Tuesday afternoon's session, over which George S. Rice, chief mining engineer, U. S. Bureau of Mines, presided. In gassy mines a larger area must be sealed so that the work may be completed and the men withdrawn before an explosive mixture approaches the active fire. In exceptional cases, the seals may even have to be located at the mine mouth.

Though in non-gassy mines temporary seals may be used to prevent the air current from circulating through a fire area, the final non-combustible seals should be built immediately after the temporary work is completed. In a gassy mine, however, these temporary seals may consist of board stoppings, latticed and faced with plaster or of a well-tamped sand fill between two board stoppings. While these seals are being erected, the atmosphere near the fire should be sampled frequently so that the builders of the stoppings can be withdrawn should the methane content near the fire become dangerously high.

Where, said Mr. Gordon, more than two seals have to be built in a gassy mine, the intake and return should be the last to be closed and sample pipes should be built into all such seals so that the atmosphere in the fire area can be determined at any time. After such an area is closed, the mine should be abandoned for 24 hours and then the atmosphere from the fire section should be tested and, if the air behind the seals is non-explosive, final seals should be erected against the temporary seals, but none of the stoppings should be removed for six weeks to six months, depending on the severity of the fire, the extent of the area closed and the nature of the roof near the fire.

Usually, before a fire section is reopened, an air lock should be built against one of the seals, so that this section can be entered and examined by a breathing-apparatus crew. If this examination proves that the temperature has been reduced satisfactorily, the section can be opened for operation, but frequently the fire area is allowed to remain closed long enough to dissipate the heat entirely, and then, after ventilation is restored, the exploration can be made by a crew without apparatus.

A faint smell like that exhaled by rubber cement heralds the first stages of spontaneous combustion. As the fire progresses the atmosphere has a sooty smell. In gassy areas, particularly if kept under a gas blanket, heating cannot be satisfactorily extinguished by direct attack. Sometimes, by speeding the rate of extraction, the fire is buried and thus covered by a gas blanket, but usually the section has to be sealed.

In most instances the nose will detect fire sooner than tests made for carbon monoxide, unless such tests are unusually delicate. Gob stink, however, does not always connote gob fire. The Foord bed of the Pictou coal field in the Allan colliery, normally 35 to 40 ft. thick, so deteriorates toward its eastern fringe that only 3 ft. of it, 9 ft. below the top, is workable. In mining this thin bench of coal, "fire smells" developed, but closer examination showed that they arose not from fire but from unsaturated hydrocarbons in the seam and in overlying strata. Boreholes drilled 12 ft. into the coal rib and 20 ft. into the roof quickly filled with a gas which analyzed as in the accompanying table.

Gas From Roof of Foord Bed, Allan Colliery

	Percentage
Carbon dioxide	0.5
Oxygen	1.7
Carbone monoxide	0.004
Methane or ethane	87.2
Nitrogen	10.596

Analysis showed eleven times as much methane as ethane. As the holes were bored close to an advancing face, the carbon dioxide could not have entered from the outside atmosphere. Furthermore, as the procedure quickly reached 1-in. water gage and did not change for some months, the gas sampled must have come from the measures which the drills penetrated.

An area in Albion colliery plagued with weak shale roof and floor was developed by six narrow, steeply ascending rooms, narrated Mr. Gordon, and the pillars in this 20-ft. bed were allowed to stand for some time. Though the places were narrow, they filled with crushed coal and timber. Before pillaring was commenced, fallen material was removed from the rooms but not from the crosscuts.

Drawing of the ends of pillars in the

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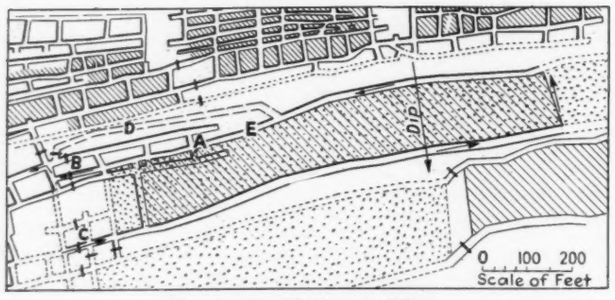
Nova Scotia Mining Society Leaders, 1937-38

Alexander MacEachern, chief inspector, Dominion Coal Co., Glace Bay, was elected president of the Mining Society of Nova Scotia at its fiftieth annual meeting, held June 22-25 in Halifax and Sydney, N.S. Other officers are: D. F. McDonald, department of geology, St. Francis Xavier University, Antigonish, first vice-president; A. E. Flynn, professor of mining, Nova Scotia Technical College, Halifax, second vice-president; S. C. Mifflen, office engineer, Dominion Coal Co., Sydney, Secretary-treasurer.

Councillors are: J. L. Bowlby, analytical engineer, Dominion Steel & Coal Corporation, Glace Bay; G. G. Bowser, explosives division, Canadian Industries, Ltd., Halifax; T. J. Casey, chief inspector of mines, Nova Scotia, Halifax; R. Dickson, superintendent, Nova Scotia Steel & Coal Co., Sydney Mines; J. R. Dinn, district superintendent, No. 4 Colliery, Dominion Coal Co., Ltd., Glace Bay; H. C. Gordon, assistant to general manager, Dominion Steel & Coal Corporation, Stellarton; F. W. Gray, assistant general manager, Dominion Steel & Coal Corporation, Sydney; A. L. Hay, assistant mining engineer, Dominion Steel & Coal Corporation, Glace Bay; Harry Hines, district superintendent, No. 12 colliery, Dominion Coal Co., Ltd., New Waterford; T. L. McCall, chief mining engineer, Dominion Steel & Coal Corporation, Sydney; D. H. McDougall, consulting mining engineer, Montreal, Que.; J. P. Messervey, deputy inspector of Nova Scotia, Halifax; J. C. Nicholson, general superintendent, Dominion Steel & Coal Corporation, Glace Bay; W. L. Stuewe, mechanical superintendent, Dominion Steel & Coal Corporation, Glace Bay; D. H. MacLean, superintendent, Acadia Coal Co., Stellarton.



Fire in the McGregor Mine

The upper, or Fleming, seam workings shown in dotted lines with gob as fine dots and lower, or McGregor, seam working in solid lines with crosshatched waste.

higher parts of the workings made it necessary to cause the ventilating current to return to the entry in the lower part of the section instead of allowing it to escape at the upper end. More or less of this air passed through at least two of the entry crosscuts that had not been stopped effectively. In one of these smoke developed, and it was thought best to dig out the heating and not to try to smother it by seals, for it was feared that if the section was sealed, most of the gas evolved in the area would go first to the higher reaches and would not appear in sufficient concentration near the heated material to blanket the heating and prevent it from bursting into flame.

Water lines accordingly were laid to the incipient fire, the section was rock-dusted heavily and brattices were erected to keep the gas which escaped from the measures into the rooms from reaching the crosscut, as it might have done with a drop in barometric pressure. Sixty hours of continuous fire fighting extinguished the heating, but later a stink developed in the second crosscut. However, the ribs of this crosscut had been thickly covered with rock dust and, the partially built seals having been closed, combustion was suppressed.

Citing another fire—this in a longwall gob of the McGregor mine—Mr. Gordon said that the Fleming bed at that mine is 5 ft. thick and underlaid by 5 ft. of carbonaceous shale under which is the McGregor bed, which is 20 ft. thick. The Fleming bed had been worked to the boundary of the mine by advancing longwall, after which similar work was commenced in the upper 8 ft. of the McGregor bed.

After the McGregor longwall had advanced about 900 ft. a fire smell was noted issuing at *A* (see illustration) from the packs along the side of the road about 125 ft. from the commencement of the McGregor longwall. At this point a crosscut in an old entry broke through into the longwall. The heat was thought to be in the roadside pack, so it was decided to dig out the smoldering material, and, when holes were dug into the pack, it was found that, though the Fleming gob had consolidated, that in the McGregor was loose and filled with fallen masses of coal and shale. The gob was penetrated for a short distance, but the heating could not be located.

Meantime, the temperature of the waste had risen from 100 to over 120 deg. F., and the carbon-monoxide content of samples drawn from inside the packs had reached 0.2 per cent. So the entire McGregor longwall was sealed by stoppings at *B* (the return) and at *C* (the intake).

After two months, no carbon monoxide was found behind the seals, and six months after the closing, the section was reopened, the roadways were repaired and the packs at *A* tightened, but, seven days after opening the seals, fire smell again issued from the packs, and the section was closed.

After a further four months, the section again was opened and the face was advanced 20 ft. further and under this fresh roof a pack 10 ft. thick was built between the upper and lower roads parallel to the face to prevent air from leaking from the face through the gob to the point *A*. Efforts were made to reinforce the packs in the vicinity with a sand fill and to reach unbroken roof over the crosscut at *A*, but before this could be done, the road in the upper roadway carried an increasing quantity of carbon monoxide. When that content reached 0.1 per cent between *A* and *B*, the section was reclosed.

Within 20 hours, samples drawn through the stopping at *B* showed 1.5 per cent of carbon monoxide, and a month after the reclosing, the atmosphere of the roadway showed 18 per cent carbon dioxide, 0.2 per cent of carbon monoxide, 0.8 per cent of oxygen and 55 per cent of methane.

Evidently, some different method must be adopted, and a roadway, *D*, has been started in the lower part of the McGregor seam to lead around the fire starting behind the seal *B* and connecting with the roadway at the point *E*, between which latter and the fire a stopping will be constructed so that the upper roadway from *B* to *E* will be kept under a gas blanket. The section has been closed for six months. In this instance also unconsolidated combustible material and a leakage of air current were the cause of the trouble.

Again Mr. Gordon recalled a spontaneous ignition in narrow rooms filled with crushed coal—this time from roof as well as ribs—and with timber; a fire started in Allan colliery apparently in one of these rooms and was not noticed because probably too much air was traveling. On a public holiday two examiners were alone in the mine when an explosion occurred which carried fire into the airway which became beyond control.

As the mine liberates 2,000 cu.ft. of methane per ton mined and a near-by pillar section was being extracted with a gas-blanketed gob, it was decided to reduce fan speed and prepare covers for the shafts. These covers consisted of planks bespread with canvas and loaded with 2 ft. of sand. Within 20 hours five minor explosions occurred, as shown by a recording water gage. None of them displaced the shaft covers.

On reopening it was found that the lower roadway in the fire section was sealed with rising water. The upper roadway had a stopping with a 6x6-ft. opening. A steel plate was floated from the bottom of the shaft to close the opening, for the shaft bottom was covered with 5 ft. of water; explorations were then made by breathing-apparatus crews. The fire area was still hot when explored later and it began to get hotter, but before it had time to be dangerous, temporary stoppings were erected and permanent stoppings followed.

Forecasting Here to Stay

Planning in coal mining is inevitable, declared J. F. K. Brown, assistant to the vice-president, Hudson Coal Co., Scranton, Pa., in a paper presented by John Moffat, inspection department, Dominion Coal Co. In every industry, planning is an accepted practice, and coal mining cannot escape it. The question is not whether it is to be done but how. Forecasting is to be assumed, not debated. Schedules and quotas are today such a part of our life they cannot be ignored or evaded.

Wrong decisions made today for some temporary advantage have the knack of rising to discommode one in the future, perhaps as much as ten years later. A man-made factory, shut to meet a passing condition, can be boarded up and kept in reasonable condition and can be put in operation later not much the worse for its idleness and without much loss, but a mine must be kept dewatered, its roof must be supported, its gas watched and its equipment maintained. In planning, production always must be coordinated with selling.

Planning, detailed Mr. Brown's paper, (a) contributes to a more complete understanding and control of property management, for, if one knows how long one colliery or section will continue to produce, one knows when and where the slack caused by its non-operation should be taken up; (b) facilitates provision for capital needs; (c) simplifies the handling of depletion and depreciation requirements, for the physical life of a unit or its obsolescence may not be its true life but that life may be determined by the duration of the job the machine has to perform, especially if the machine would be of little utility in some other location or would sell at any time at a negligible figure; (d) prevents wasteful expenditures and determines many policies and principles.

Many important questions affecting company progress never are decided because the basal policies and principles of the company are not definitely determined. One cannot progress to a goal unless the goal is known.

Planning should be based, continued Mr. Brown's paper on: (1) a tonnage inventory, (2) a production forecast, and (3) an expenditure program. Relative to the production forecast, the price of coal delivered to the car is an average cost of the coal from all the sections of the mine or property, some of which produce coal at a low cost and some at a high cost. Naturally, the low-cost coal is preferred, but at what loss in the long run to the operation? Human nature being what it is, some form of control is nearly always advisable. Honest and capable bosses will keep within bounds, but others, if not watched, will take out even the shaft pillars. A production forecast enables management to keep actual development underground in line with requirements and not ahead or behind them.

Provision for expenditures should not be based on a certain sum per annum but on the new items which the production forecast sets forth. No budgetary allowance should be spread according to size, tonnage or number of collieries hungry for money, but according to their several scheduled needs. Such a budget should cover both new and maintenance items.

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Earle Signs Pollution Bill

A bill to check pollution of Pennsylvania waters was signed by Governor Earle at Harrisburg late in June. The measure empowers the Sanitary Water Board to protect all sources of water supply, present or future, fines and prison sentences being established for violations. Exemption from the ban on emptying industrial waste into State waters is granted for acid mine drainage from coal mines in active operation at the time of the adoption of the act. This exemption will remain in effect until such time as in the opinion of the Sanitary Water Board practical means of treatment become known.

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Anti-Smoke Law Upheld

Constitutionality of the St. Louis (Mo.) smoke-abatement law was sustained on July 10 by federal Judge George H. Moore, who denied an injunction to Samuel White and Frank Sergent, St. Clair County (Illinois) operators (see *Coal Age*, July, 1937, p. 343). The court held that the ordinance was to improve public health and welfare, and that smoke and its component gases, fumes and ash caused loss and damage to property and health, and was a public nuisance. It also was found that washing and hand-picking provisions of the measure would serve to reduce sulphur fumes, fly-ash content of smoke, and facilitate successful use of mechanical underfeed stokers.

How Coal Tests Fit Consumer Needs Detailed in A.S.T.M. Symposium

TO ascertain how laboratory studies of coal meet consumer needs was the purpose of the Symposium on Significance of Tests of Coal, held June 29, by the American Society for Testing Materials at its fortieth annual meeting, in the Waldorf-Astoria, New York City. Changes in standards were approved subject to letter ballot. In his annual address, the president estimated that the coal resources of the United States would fill our domestic need for 2,100 years.

The relative position of a coal when coals are ranked in the order of grindability still depends in a measure on the method used for this determination. No

A. C. Fieldner
Retiring president, A. S. T. M.

two methods place coals in the same relative rank, asserted A. C. Foster, briefing the paper by Martin Frisch and himself, chief engineer and pulverizer engineer respectively, Foster Wheeler Corporation, at a session over which A. C. Fieldner, chief engineer, Experiment Station Division, U. S. Bureau of Mines, presided.

In properly standardized tests of commercial pulverizers, coals appear to be less divergent in their pulverizing qualities than in standard laboratory tests. Laboratory grindability ratings are useful and may be used before test to predict what a pulverizer will do to coal of known grindability, but only if tests have already determined the relative grindability capacity of the pulverizer and if the effects of such other factors as feed size, moisture and fineness, which tend to mask the grindability, have been duly considered.

One cannot be sure that even a coal of high ash-softening temperature will not clinker, declared A. W. Gauger, professor of fuel technology, Pennsylvania State College, for temperature, time of exposure to that temperature and travel of ash also are variable. Temperatures in the fuel bed, asserted Dr. Gauger, are high enough to soften the ash of almost any coal.

Differences in sampling of certain sizes may cause deviations in ash-softening determinations as high as 500 deg. F. Variations in the mineral matter in the coal from place to place and in the various fractions of different specific gravities and in the vitrain, clarain, durain and fusain explain some of the uncertainties.

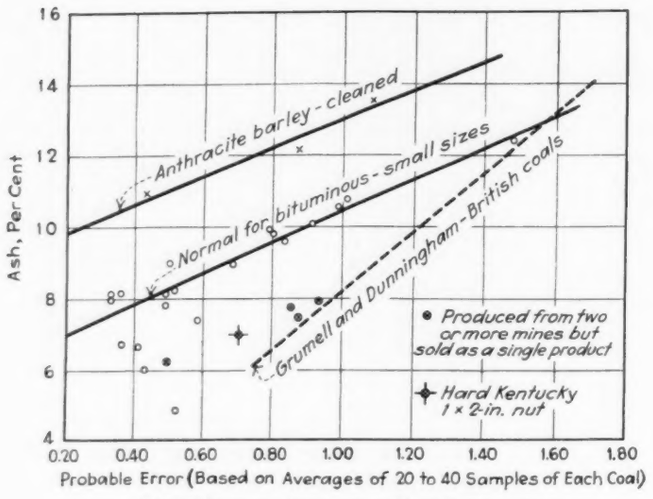
Many hold that, because the ash is intimately mixed when the sample is being prepared for test, it cannot be truly representative of the segregated conditions of the fuel bed. In burning, if a lump of coal is not disturbed, the combustible matter burns away, leaving the ash more or less in place, but with some shrinkage. Infusible components remain as flaky or fluffy ash; fusible constituents sinter or melt into globules (depending on temperature-composition reactions) and work their way down to the grates, in which process the different constituents come into more intimate contact. Agitation of fuel bed, which aids in movement of individual ash particles, enables the fused masses to coalesce and react on each other.

Formation of troublesome clinker, urged Dr. Gauger, is dependent on equipment and firing practice as well as on inherent characteristics of coal and ash. The national committee on coal of the National Association of Purchasing Agents rates excessive load on the grate, insufficient grate area to heat area, preheated air and unfavorable conditions as more important than ash-fusing temperature in the case of underfeed stokers with water-cooled tuyeres.

Quoting G. B. Gould, Dr. Gauger said that a fire densified by undersize tends to clinker. With exclusion of fines, coal can be burned at high rate and at high temperature without clinker trouble. Sometimes, he added, the presence of large quantities of ash prevents clinkering, despite low ash-softening temperatures and high rates of combustion (50 lb. per square foot per hour). Ash seems to act as an insulator, but in some cases high ash causes troublesome clinker.

The relation of clinker trouble to laboratory fusibility tests would be better understood if the particular trouble were stated, advanced Dr. Fieldner. In the Detroit Edison Co. plants, said A. H. Thorson, of that company, no correlation of fusion temperature with clinkering has been found for coals having fusing points between 2,400 and 2,900 deg. F., but the management has found it best to buy only coals with an ash-fusion temperature exceeding 2,500 deg. F., so that no trouble will be likely to occur.

It is not easy to foresee how a coal with a given burning rate will act, ex-



Probable error increases with ash percentage

plained J. S. Bennett, American Engineering Co., for if the average burning rate is 45 lb. per square foot, some of the fire may have a burning rate of 70 lb. per square foot with temperatures correspondingly higher. Much is being done to sectionalize the fuel bed, so that the rate of burning can be kept under control.

Not enough attention had been paid to the interval between the initial deformation of the fusion cone and its point of fluidity. The longer that interval, the worse the clinkering tendency, declared R. L. Rowan, fuel engineer, General Coal Co., a statement indorsed later by R. M. Hardgrove, Babcock & Wilcox Co.

Ash-fusing temperatures have been abused, in the opinion of Percy Nicholls, in charge of fuels section, U. S. Bureau of Mines. Were strengths of materials applied to a bridge without reference to size of members and the stresses in them, correlation between such laboratory determinations and the strength of the structure would be impossible. So also in using laboratory determinations of ash-fusing temperatures for correlation to clinkering, consideration must be given to conditions of the fuel, agitation and equipment.

Intervals between initial deformation, softening temperature, and fluidity can be used with advantage, also viscosities of fluid slag. He, like others, thought that clinker trouble always should be vigorously defined. The "fluid interval" gives the technician an idea of the analysis. With a low-ash-fusion coal, declared R. E. Gilmore, senior engineer and chemist, Fuel Research Laboratories, Canadian Bureau of Mines, the high-temperature coke gave much clinker trouble, but the low-temperature coke gave none, because the lower fuel-bed temperatures prevented clinkering.

The melting point was quite significant, for it was reproducible within 50 deg. F., whereas the softening range might vary in two determinations by 250 deg. Initial deformation also cannot be accurately checked.

Ash-softening temperature is no sure guide to clinker trouble, said W. M. Ritchie, fuel engineer, Chesapeake & Ohio Ry., in confirmation of previous speakers. Human factors in operation and types of equipment play important parts in development of clinker. In one case a coal with 2,800-deg. F. softening temperature was replaced by a coal with 2,500 deg. F. With modifications in equipment, the second coal makes no more clinker than the first.

The intimate mixture in the laboratory sample and the segregated materials in the furnace do not constitute a negligible difference, commented R. A. Sherman, Battelle Memorial Institute. Analyze the pieces of ash, even those in an underfeed stoker, in which equipment mixing is more intimate than with other stokers, and it will be noted that these pieces do not have the same analysis as the entire ash. This is one reason why clinkering conditions vary even with identical softening temperatures.

In reply Dr. Gauger said he recognized the importance of the viscosity of slag. He noted that some wanted a wide interval and some a narrow interval between initial and fusing temperatures. That depended on the causes of fluidity. Iron oxide and alkali oxides had different effects.

Seldom do two coals differ from each other in only one of their many properties, observed G. B. Gould, president, Fuel Engineering Co., New York, with J. B. Morrow, preparation manager, Pittsburgh Coal Co., in the chair. With different combinations of properties of coal and with a great variety of combinations of conditions in use, it is easier to explain the conditions in an actual case than to arrive at general conclusions.

Because of the heat needed for evaporation and for raising the evaporated moisture to the temperature of the fuel gases, moisture reduces the available heat in coal 0.1 per cent for each per cent of moisture. High surface moisture lowers the capacity of some pulverizers and may make them inadequate. Addition of surface moisture to coking coals improves the structure of the fuel bed, particularly with mechanical agitation, as with chain grates. It increases the uniformity and porosity of the fuel bed and the rate of ignition and thus raises efficiency.

Saving From Low-Ash Content

Quoting E. S. Grumell, Imperial Chemical Industries, of Great Britain, Mr. Gould declared that the efficiency of a fuel decreases by one-third of 1 per cent for each 1 per cent in ash content, though, when carbon losses are not controlled and where the coal is of such poor quality that an appreciably greater draft is required to maintain output, the effect on efficiency may be somewhat more pronounced.

Probable error in sampling increases with increase of ash percentage, as shown by tests with 25 bituminous and 3 anthracite coals. Thus with a coal of about 7 per cent ash the probable error will be 0.20 and with 13 per cent ash about 1.60. British coal samples seem to have smaller probable errors; about 0.85 for coals with 7 per cent ash, according to Dr. Grumell and A. C. Dunningham, but coals with 13 per cent ash have a probable sampling error of 1.60, as with American sampling. Mr. Gould explained this by saying that the cleaner British coals have a larger percentage of free ash than American coals, but that the dirtier coals have possibly about the same quantity.

In considering the probable error in sampling, consideration has to be given to the inherent and the free ash in the coal, declared Dr. Grumell, in a written communication. Free ash causes larger deviations than inherent ash. To avoid sampling errors, said O. O. Malleis, Appalachian Coals, Inc., the gross sample should be ground. A small gross sample thus pulverized would give a more accurate result than a larger gross sample quartered without grinding.

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PERMISSIBLE PLATES ISSUED

FIVE approvals of permissible equipment were approved by the U. S. Bureau of Mines in June, as follows:

Goodman Manufacturing Co.: Type 7504T storage-battery locomotive; Approval 1529; June 3.

Joy Manufacturing Co.: Type 12 BU-4 (Joy Jr.) loading machine; five 4-hp. motors, 250-500 volts, d.c.; Approvals 317 and 317A; June 10.

Joy Manufacturing Co.: Type PL9-2 portable conveyor; 4-hp. motor, 250-500 volts, d.c.; Approvals 318 and 318A; June 22.

Goodman Manufacturing Co.: Type G-20-B-77 shaker conveyor; 20-hp. motor, 500 volts, d.c.; Approval 319A; June 25.

Sullivan Machinery Co.: Type 5-B mining machine; 15-hp. motor, 220-440 volts, a.c.; Approvals 320 and 320A; June 28.

At the afternoon session, with Dr. Gauger in the chair, Dr. Fieldner presented reports of the committees on gaseous fuels, coal and coke and classification of coals (committees D-3, D-5 and M-20, respectively). All were accepted for publication and the last two accepted for standards subject to the letter ballot of the society. Several minor changes have been made in ball-mill and Hardgrove-machine methods for determining the grindability of coal.

High-sulphur coal may (1) give clinker trouble; (2) slag in the furnace; (3) coat with slag, and thus foul, heat-absorbing surfaces; (4) cause corrosion; (5) pollute the atmosphere; and (6) ignite spontaneously in storage piles and bunkers, declared Henry Kreisinger, in charge of development and research, Combustion Engineering Co., Inc., with Mr. Gould in the chair. Even if the high-sulphur coal is substantially cheaper than the low-sulphur coal, experienced buyers will not contract for it without thorough trial. Sulphide iron usually burns to SO_2 or SO_3. In a reducing or partly reducing atmosphere, iron sulphide, or pyrite, may not be completely oxidized and some ferrous sulphide may remain. Low oxides of iron, or even metallic iron, may be formed. Organic sulphur also burns to SO_2 or SO_3, and the sulphates decompose at high temperatures into metallic oxides and to SO_2 and SO_3. Slag seriously reduces the steaming capacity of the plant.

Pyrite Lenses Less Harmful

When coal is burned on hand- or stoker-fired furnace grates, clinker troubles usually are less serious if the pyrites occur in large lumps or disks than when uniformly distributed, because the large lumps are mostly separated from the coal and because, being heavier than coal, they sink to the grate out of the high-temperature zone and may not reach the softening point. Less sulphur and iron is carried by the gases into the boiler and the heating surfaces are less likely to be covered by slag with large pyrite sulphur than when that material is disseminated. In burning pulverized coal the pyrite is distributed and may cause slagging of furnaces and boiler.

Iron, not sulphur, in pyrite causes clinkering trouble. Analyses of clinker showed less than 0.5 per cent sulphur, said Dr. Nicholls, with some clinker having only 0.2 per cent. The highest value was 2 per cent, and that was not the percentage of the sulphur constituent but of SO_3. In all cases sulphur was present in the clinker as a sulphide, entrained in the slag and not an integral part of it.

Distributed pyrite is more harmful than segregated. Pyrite will form stalactites in the furnace if present in quantity, and in a molten slag bed may be extremely troublesome. It may appear as a "burning serpent" on tapping a slag-tap furnace and deliver a poisonous gas. In pulverized-coal installations, the pyrite burns slower than the coal and falls to the bottom of the furnace. Frequently free iron is formed by the pyrite.

Too often, urged Dr. Rowan, is spontaneous combustion charged to sulphur, though it is only one of the causes. Gases from the hopper bed, declared Dr. Sherman, are injurious to men working overhead. Sulphur also makes much trouble in ash rooms. If the sulphur is organic, asserted Dr. Kreisinger, more of it becomes SO_3 and H_2SO_4, with consequent corrosion. It gives more trouble with fuel oils, for there it is all in organic form. Two per cent organic sulphur will give highly corrosive gases, but the same percentage as pyrite will not. Though H_2SO_4 boils at 600 to 630 deg. F., it will condense at 300 to 350 deg. and badly corrode air heaters. Condensation will depend, of course, on the partial pressure and on the water in the gases. The damage done is not so much in running the air heater, in which case a high temperature is established, as in starting and shutting down, for then the temperature is lower and condensation occurs.

For the caking, plastic, gas- and coke-making properties of bituminous coals, the A.S.T.M., declared Dr. Malleis, has not yet prepared even a single tentative standard, and regarding only one item --the agglutinating property of coal— has an information statement been printed.

For caking properties, the coke-button test is available. It determines the bearing strength in kilograms of the product left when volatile matter is driven from the coal in the crucible to ascertain its quantity. The agglutinating test with Ottawa sand, in proportions 15:1, 20:1, 25:1 or 30:1, indicates the deterioration of the coking properties of coals in storage, but, according to Dr. Malleis, it seems to have little reliability as an index of probable caking or coking properties.

Strong coking coals, as determined by these tests, form a coke or mat over the fuel bed which cannot be readily broken up in normal operation. On residential stokers, coke trees are formed by such coals, and these materially disturb the fuel bed. In ovens, coke produced by these coals is of the desired size and of a strength that will resist mechanical handling without forming excessive breeze.

In the Layng and Hathorne test, the plastic properties of coal are ascertained by noting the resistance which a heated bed consisting of a mixture of ten parts coal to four parts electrode graphite will oppose to the passage of nitrogen. Temperatures are taken at the moment when resistance develops and again when it drops. When the passage of gas is resisted, the "melting point" of the coal is supposed to be reached. Though the test is not considered reliable, a large byproduct plant, asserted Dr. Malleis, has used it in grouping high-volatile coals of similar melting point so as to determine which coals without blending will produce the best coke from a physical standpoint.

With the Agde-Damm test, which measures the linear expansion or contraction of a test sample, temperatures are taken at the first contraction and expansion. Then another briquet is heated to 932 deg. F. and its swelling coefficient taken. The temperature of initial contraction is materially lower than that given by the Layng and Hathorne test or the plastometer test (see later). Temperature of initial expansion agrees fairly well with the temperature at which resistance develops in the plastometer. This Agde-Damm test has still to be correlated to plant performance.

Plastometer Indicates Class

In the plastometer test of J. D. Davis, U. S. Bureau of Mines, resistance to a rotative movement of a needle through coal is measured continuously while the latter is being heated through the plastic stage. Resistance increases rapidly when the increased temperature brings the coal to that stage, but with higher temperatures it decreases, for the coal becomes more fluid. Ultimately chemical changes make the coal more viscous, and resistance increases until solidification occurs. Then the coal breaks up and practically ceases to restrain movement.

These plastic-range values seem to be promising as an aid to the classification of high-volatile coal as free-burning or caking. Those coals that offer no resistance in the Davis plastometer would generally be classed as free-burning. Plastometer data seem to have practical significance both in carbonization and in burning of coal in stokers. The test of V. J. Altieri, which measures the expansion of 8 lb. of coal through the entire coking period, has not been sufficiently correlated to byproduct-coke-making conditions, but it seems to have value.

Laboratory distillation, or "tube," tests mainly determine the volatile yields from the carbonization of coal.

SMALL STOKER SALES MOUNT

Sales of mechanical stokers in May last totaled 6,782 units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers (Class 1, 58; Class 2, 31; Class 3, 32; Class 4, 27; Class 5, 15). This compares with sales of 6,094 units in the preceding month and 3,959 in May, 1936. Sales by classes in May last were: residential (under 61 lb. of coal per hour), 6,096 (bituminous, 5,624; anthracite, 472); small apartment-house and small commercial heating jobs (61 to 100 lb. per hour), 279; apartment-house and general small commercial heating jobs (101 to 300 lb. per hour), 205; large commercial and small high-pressure industrial steam plants (301 to 1,200 lb. per hour), 124; high-pressure industrial steam plants (over 1,200 lb. per hour), 78.

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The coal is heated to 1,652 deg. F., and even somewhat higher, in a transparent quartz tube held in a horizontal position, usually in a gas-fired furnace. If only volatile yield data and B.t.u. in gas are desired, this, asserted Dr. Malleis, is the logical test to employ.

The BM-AGA test carbonizes 85 to 175 lb. of coal in a retort of 13 to 18 in. diameter. Tests may be made from 932 to 2,012 deg. F. Ammonia is always found in too low a quantity in this test, because it is decomposed by the iron of the retort. Best results for light oil are obtained at 932 deg. F., for tar at 1,832 deg. F. and for gas and B.t.u. in gas per ton of coal between 932 and 1,832 deg. F. Specific gravities of the coke are about 0.1 too low, and the quality of the coke is not so good as that made in the byproduct oven. Light-oil, tar, gas and B.t.u.-in-gas yields in the BM-AGA test, taken at the temperatures stated, indicate results that may be expected in practice.

With the Meeker burner as a source of heat in the volatile-matter test, swelling coals expanded to the top of the crucible, stated Dr. Sherman, but, with electricity as the heat source, the swelling was not abnormal (*Coal Age*, June, 1937, pp. 299–300). Rate of gas evolution, added B. P. Mulcahy, Citizens Gas & Coke Utility Co., has much influence on expansion. The company has found that swelling decreased when coking time was raised from 24 to 48 hours.

Small-Oven Test of Value

According to C. A. Lund, Consolidated Edison Co. of New York, the use of the Bureau of Mines small-oven test had enabled his company to presage the performance in commercial ovens of such coals as they thought might be suitable for their purposes. Each test operated on a ton of coal and cost $500. The value of the agglutinating test was questionable and its reproductibility imperfect. Coals made dangerous by excessive swelling, said C. C. Russell, Philadelphia Coke Co., may be made harmless by mixing, but, should they become segregated, they may again become dangerous.

What relation have caking, plastic, gas- and coke-making properties to fuel-bed operation? asked Mr. Gould. Because air plays around the coal particles in the furnace, the coal loses its caking characteristics, said Dr. Nicholls. With a dense bed, however, the test results will be obtained. Where the tar is burned as evolved, the coal cannot be expected to agglutinate.

Friability tests measure the liability of a material to break into smaller pieces on handling, declared Dr. Gilmore and J. H. H. Nicolls, chemist, Fuel Research Laboratories, Canadian Bureau of Mines, in a paper briefed by the senior author.

Messrs. Gilmore and Nicolls recommend that friability be expressed thus: "Handling properties in respect to friability 88-22," where 88 would be the size stability per cent to the nearest whole number as obtained by the drop shatter test on standard 2- to 3-in. lumps, and 22 would be the friability per cent, also to the nearest whole number as obtained by the tumbler-test method. Ball-mill or Hardgrove-machine grindability might be appended to these values either in abbreviated or symbol form.

Coal in the bed is stronger than mined coal or coal mined and delivered, and the coals described by Messrs. Gilmore and Nicolls were all more or less shattered and some weakened by dehydration, said R. D. Hall, engineering editor, *Coal Age*. The harder the coal, the more heavily it is shot. Not until coal is reached 18 ft. beyond a face which has been mined by explosives does coal appear that can be sawn satisfactorily into blocks.

At the opening session, June 28, Dr. Fieldner, president of the society, discussed "Fuels of Today and Tomorrow" and estimated that "not more than 2 per cent of the original supply of bituminous coal and about 25 per cent of our anthracite has been exhausted. At the 1929 rate of energy consumption, assuming that coal will carry the load after oil, gas and oil shale are exhausted and allowing 30 per cent for loss, coal would last 2,100 years."

Conservative estimates of the proved reserves of natural gas range from 30 to 40 trillion cubic feet. Other estimates are placed at considerably higher figures. At the present rate of 2 trillion cubic feet of production per year this quantity would last 15 to 20 years. New sources will be discovered and the life of the fields, no doubt, will be extended, as growing social control will prohibit waste and low-grade use of this fuel.

A committee of the American Petroleum Institute, Jan. 1, 1937, puts the oil reserve at practically 13 billion barrels. The deposits of oil shale are estimated to contain 92 billion barrels of crude oil, enough to maintain the present annual rate of oil production for nearly 100 years. A shortage of our domestic oil supply may begin within 10 or 20 years.

Ingenious as they are, the Bergius and Fischer processes are thermally wasteful methods of obtaining power from coal. About four tons of coal is required for the manufacture by the Bergius method of a ton of gasoline. The gasoline obtained contains only 40 to 45 per cent of the energy in the coal used; the recovery by the Fischer process is even less.

Harris & Ewing

Harry L. Gandy

Personal Notes

J. W. ARTHUR has been appointed foreman at the Ingram Branch mine of the Koppers Coal Co., Wriston, W. Va.

TAYLOR BLAIR has been made foreman of No. 22 mine of the Island Creek Coal Co., Holden, W. Va.

GEORGE BROWN has been appointed general purchasing agent for the H. C. Frick Coke Co., Pittsburgh, Pa., succeeding Thomas S. Duncan, who retired on July 1. Mr. Brown started with the Frick company in 1921 as coal purchasing agent.

W. M. BURRUS has been elected president of the Penn Anthracite Collieries Co., Scranton, Pa. Formerly secretary, treasurer and general sales manager, Mr. Burrus succeeds Charles Dorrance, who resigned to become vice-president in charge of operations of the Consolidation Coal Co.

J. H. CARTER, of Prince, has been appointed a mine inspector by the West Virginia Department of Mines.

C. W. CREWS has been named superintendent of the Semoco mines of the Sewell Smokeless Coal Co., Metalton, W. Va.

G. R. DANIELS has been made general foreman at the Semoco mines of the Sewell Smokeless Coal Co., Metalton, W. Va.

STANLEY DEAL has been appointed foreman of the No. 4 mine of the Kelleys Creek Colliery Co., Ward, W. Va.

BAXTER GAITER has been named foreman at the Stone Cliff mine of C. A. Brockman, Inc., Stone Cliff, W. Va.

HARRY L. GANDY has resigned the presidency of the Sheridan-Wyoming Coal Co., Monarch, Wyo., to become chairman of District 8 Bituminous Coal Producers' Board (Southern No. 2) under the Bituminous Coal Act of 1937. For several years previous to 1930 Mr. Gandy was executive secretary of the National Coal Association. He will devote his full time to his new position with offices in Cincinnati, Ohio. WAYNE P. ELLIS, formerly deputy administrator in NRA Division I, has been appointed secretary of District 8 board. Mr. Ellis' other connections in the coal industry include secretary and manager of the Northwestern Coal Dock Operators' Association and more recently with Appalachian Coals, Inc.

JOHN A. GARCIA, JR., has severed his connection with the Central Fuel Corporation, Chicago, and joined his father's

organization, the Allen & Garcia Co., consulting and constructing engineers, Chicago.

CHARLES GARDNER has been made superintendent of the No. 9 mine of the Jamison Coal Co., Farmington, W. Va.

G. E. GLENN has been appointed foreman at the Wyoming mine of the Red Jacket Coal Corporation, Wyoming, W. Va.

JAMES C. GRAY, connected with the Hudson Coal Co., in the anthracite region of Pennsylvania, for the last twelve years, has been appointed superintendent of the Wylam division of the Tennessee Coal, Iron & Railroad Co., Wylam, Ala.

DONER GREEN has been named foreman at the MacBeth mine of the Hutchinson Coal Co., Logan County, West Virginia.

G. G. GULLETT has been made foreman at the Nos. 1, 2 and 2-C mines of the Amherst Coal Co., Amherstdale, W. Va.

FRED E. GORE, vice-president, Blue Diamond Coal Co., has been elected to the board of Directors of Appalachian Coals, Inc., succeeding the late James M. Bonnyman.

OTTO HERRES has resigned as vice-president and general manager of the United States Fuel Co., Salt Lake City, Utah. A mining engineer by training and practice, Mr. Herres has been with the United States company for twenty years. Prior to becoming vice-president and general manager, several years ago, he had been assistant general manager for a long time.

LANE W. HILDRETH has been promoted by the Anthracite Institute to be secretary. He will have his headquarters at 19 Rector St., New York, E. W. Parker, who is retained as treasurer, having offices in the Lewis Tower Building, Philadelphia, Pa.

A. T. IFFINGS has been appointed assistant general manager of the Page Coal & Coke Co., Pageton, W. Va. He had been connected with the Crozer Land Co. for nearly twenty years.

MATHEW KENDO has been named foreman at the Standard mine of the Standard Coal Mining Co., Wellsburg, W. Va.

W. E. E. KOEPLER, secretary, Pocahontas Operators' Association, has been reelected first vice-president of the Smoke Prevention Association, Inc., for the fourth consecutive time.

E. W. LAMB, assistant general superintendent, Penn Anthracite Collieries Co., Scranton, Pa., has been named general manager of the company, vice Thomas F. Steele, who resigned to become an independent operator at Sheppton, Pa.

ROBERT W. LEA, president, West Virginia Coal & Coke Corporation, has been elected to the board of directors of Appalachian Coals, Inc., vice John C. Cosgrove, resigned.

Jerome C. White

JAMES LEICHTY has been appointed superintendent of Middlefork mine of the United States Fuel Co., Benton, Ill., vice MACK TAYLOR, retired.

RICHARD J. LUND has been appointed editor of the *Mining Congress Journal*, succeeding Mrs. E. R. Coombes, who has resigned to undertake private work. Mr. Lund is a graduate of the University of Wisconsin, has been employed in engineering and geological work in connection with both coal and metal mining, and for the last two years has been chief of the Economics Investigation Section of the U. S. Bureau of Mines.

C. C. MORFIT, formerly secretary of Stuart, James & Cooke, Inc., has opened an office as consulting engineer at 11 Broadway, New York.

JAMES H. PIERCE has resigned the presidency of the Scranton Coal Co., Scranton, Pa. The company is in course of reorganization under Sec. 77b of the Bankruptcy Act and its collieries have been idle since early in June.

M. E. POLLEY has been appointed foreman at the Montcoal No. 3 mine of the Colcord Coal Co., Stickney, W. Va.

L. E. SCHOLL has been named assistant general foreman of the Krebs mine of the Christian Colliery Co., Mahan, W. Va.

LAWRENCE C. SHERRILL has been elected vice-president of the United Electric Coal Cos., operating mines in Illinois and Indiana. He will continue to have headquarters in St. Louis, Mo., where for several years he has been vice-president of Coal Sales Corporation, an affiliate of United Electric.

HAROLD P. TOMPKINS has been made superintendent of mines by the Cedar Grove Collieries, Inc., Cedar Grove, W. Va.

ROGER W. TOMPKINS has been appointed general mine foreman by the Cedar Grove Collieries, Inc., Cedar Grove, W. Va.

J. W. WALKER has been named superintendent of the Cedar Grove and Belmont mines of the Riverton Coal Co., Crown Hill, W. Va.

JEROME C. WHITE, who for the last ten years has been connected with the Pittsburgh Coal Co. as production engineer and recently as assistant production manager, has joined the Hanna Coal Co. of Ohio in an operating capacity. Before becoming associated with the Pittsburgh company he was on the editorial staff of *Coal Age*.

LACO WILMOTH has been appointed foreman of the Eagle mine of the Getty Coal Co., Hepzibah, W. Va.

Urges Safety Precautions In Spray Treatment

Fine spray projected from the nozzles of oil-spraying installations to coat coal with oil to allay dust and prevent freezing is flammable, declares the Kentucky Actuarial Bureau in a mimeographed bulletin entitled "Processes, Hazards and Protection Involved in the Spraying of Flammable Dustproofing Agents on Solid Fuels." Such spray used in the open at one tipple was ignited by a miner's lamp, seriously damaging the structure. At another point, where oil was sprayed on coal in a large open hopper, a mild explosion followed by a fire burned the near-by tipple timbers.

The liquid used should be of a high flash point, above 300 deg. F. (open cup). Storage-tank capacity should not greatly exceed that of a tank car and tanks preferably should be buried. If above ground, they should be properly diked or provided with barriers so that should a tank break, no liquid could flow to other property. If not so protected tanks should be located at least 100 ft. from all important buildings. If thus guarded they should be put no less than 50 ft. from such structures. They should have 4-in.-diameter vents with weather-protecting hoods or elbows. Ends of vent pipes should be sufficiently above ground to prevent obstruction by ice and snow and more than 2 ft. in every direction from building openings.

Unloading points should be 50 ft. or more from important buildings and provided with means to prevent the oil from flowing to surrounding property. Pump buildings should be constructed entirely of incombustible material and at least 20 ft. from important buildings and be used for no other purpose. Pump assemblies should be leakproof and provided with relief valves to protect piping systems from unsafe pressures.

Lines should be strong and protected from mechanical injury. Liquid flow to spray nozzles should be controlled manually by an operative always within sight of the spray location. Automatic and conveniently located manual controls should be provided to shut off oil pump and heaters. Locations should be so shielded as to prevent blowing of spray.

Non-flammable cleaning solvents employing carbon tethachloride or a water-soluble compound such as Oakite or

caustic soda are recommended for cleaning spray nozzles or other parts of spraying equipment. All rotating machinery, belts and other equipment that may accumulate static electricity should be grounded. Electromagnets should be installed well ahead of spraying location to exclude hard metallic materials, like pyrites, which may emit sparks. Coal-handling equipment should have anti-friction bearings. Heaters should have approved heat-control devices and vacuum and pressure relief valves, which latter should be attached to permanent drains.

New Stripper Planned

A plot of coal land comprising about 400 acres, south of Brazil, Ind., has been leased by the Electric Shovel Coal Corporation, which contemplates starting stripping operations there. The company's Staunton mine is near Brazil.

Bootleggers Get Wage Rise

Operators of nineteen "independent" breakers near Minersville, Pa., raised pay ½c. per cubic foot to workers on June 25, ending a strike of 1,500 self-employed miners. The workers had quit work several days previous demanding 7c. instead of 6½c. per cubic foot.

Sinks New Colorado Mine

Construction work in connection with the sinking of a new shaft mine has been begun in the South Fremont County coal field of Colorado by W. D. Corley, Jr., who recently purchased 800 acres of coal land there from the Cherokee & Pittsburg Coal Co.

Truax-Traer Leases Tracts

Truax-Traer Coal Co. operating in Illinois, North Dakota and Kanawha County, West Virginia, has leased two tracts of coal land in Raleigh County, adjacent to its other West Virginia property. One tract, comprising over 8,000 acres, leased from the Western Pocahontas Fuel Co., lies in the heart of the Dorothy seam basin. The second tract was leased from the Rowland Land Co.

20 Die in Indiana Blast

Twenty miners were killed in an explosion in the Baker mine of the Glendora Coal Co., near Sullivan, Ind., on July 15, and nine others were injured, three of them so seriously that it was thought likely that they would die. Thus far, the cause of the blast is not known, and company officials said its origin might never be known. The explosion occurred about two miles from the tipple half an hour after 203 employees went to work.

Obituary

PETER M. PELTIER, 74, for many years president of the Boulder Valley Coal Co., operating in Weld County, Colorado, and vice-president of the Keystone Coal Co., operating in Routt County, died July 7 in St. Joseph's Hospital, Denver. A native of Braidwood, Ill., he went to Colorado 55 years ago.

WILLIAM MONAY, 60, owner and manager of the Monay Coal Co., with offices at Salt Lake City and a mine at Scofield, Utah, died June 24 in a Salt Lake City hospital after an operation for peritonitis.

WALTER D. BARRINGTON, 52, research engineer with the Consolidation Coal Co. since 1909, died July 15 at his home in Upper Montclair, N. J. A graduate of Ohio State University, as well as of New York University, he took a prominent part in the work of coal classification under the N.R.A. and the first Guffey Bituminous Coal Act.

Industrial Notes

WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has appointed H. F. Boe as commercial manager. Mr. Boe, who has been associated with the company since 1900, will have headquarters in the Union Bank Building, Pittsburgh, Pa., and also at 150 Broadway, New York.

NATIONAL ASSOCIATION OF PURCHASING AGENTS has elected as president for the current year George P. Brockway, purchasing manager of the American Optical Co. Formerly vice-president of the New York Purchasing Agents' Association and a former vice-president and national director of the New England Purchasing Agents' Association, Mr. Brockway moves up from the vice-presidency of the national association.

JOSEPH T. RYERSON & SON, INC., Chicago, has elected as president Everett D. Graff, formerly first vice-president. He has been with the company ever since his graduation from college in 1906. W. F. Kurfess and V. H. Dieterich, assistant vice-presidents, have been made vice-presidents, and Ainslie Y. Sawyer, formerly assistant vice-president, has been appointed assistant to the president.

BUFFALO SCALE CO. has appointed E. J. Kelly, 2010 Locust St., St. Louis, as distributor for Missouri and southern Illinois.

CATERPILLAR TRACTOR CO., Peoria, Ill., has promoted L. J. Fletcher, formerly head of the agricultural sales division, to assistant general sales manager; C. M. Burdette, former assistant to L. B. Neumiller, has been advanced to manager of the central sales division; Charles A. Spears, who has been supervisor of special representatives, has been named manager of allied equipment sales; Floyd E. Rusher, agricultural sales manager of the eastern division, has been promoted to assistant sales manager of the central division.

AMERICAN ENGINEERING CO. has transferred Simeon Jester, Jr., from the sales department of its Philadelphia (Pa.) office to the Chicago office.

Mine Fatality Rate Recedes

Coal-mine fatalities caused the deaths of 57 bituminous and 13 anthracite miners in May last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 29,980,000 tons, the bituminous death rate in May was 1.90 per million tons, compared with 2.10 in the preceding month and 1.54 in May of last year. The anthracite fatality rate in May last was 3.09, based on an output of 4,204,000 tons, as against 4.31 in the preceding month and 3.06 in May, 1936. For the two industries combined, the death rate in May last was 2.05, compared with 2.56 in the preceding month and 1.75 in May, 1936.

Comparative fatality rates for the first five months of 1936 and 1937, by causes, are given in the following table:

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

January–May, 1936 and 1937

	Bituminous				Anthracite				Bituminous-Anthracite	
	Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons		Killed per Million Tons	
Cause	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
Falls of roof and coal	251	216	1.462	1.135	62	57	2.454	2.466	1.590	1.279
Haulage	62	93	.361	.489	7	13	.277	.563	.350	.497
Gas or dust explosions:										
Local explosions	6	3	.035	.016	11	.....	.436	....	.086	.014
Major explosions	8	27	.047	.142	....	....	....	....	.041	.127
Explosives	15	7	.087	.037	7	8	.277	.346	.112	.070
Electricity	8	18	.047	.095	4	1	.158	.043	.061	.089
Mining machines	8	6	.047	.031	....	....	....	....	.041	.028
Other machinery	4	3	.023	.016	1	....	.040	....	.025	.014
Miscellaneous:										
Minor accidents	14	10	.082	.052	11	5	.436	.216	.127	.070
Major accidents	....	....	....	....	....	....	....	....	....	....
Shaft:										
Minor accidents	3	10	.017	.052	4	1	.158	.043	.035	.052
Major accidents	....	....	....	....	....	....	....	....	....	....
Stripping or open-cut	5	4	.029	.021	4	4	.158	.173	.046	.037
Surface	13	28	.076	.147	9	7	.356	.303	.112	.164
Total	397	425	2.313	2.233	120	96	4.750	4.153	2.626	2.441

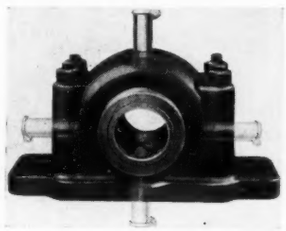
* All figures subject to revision.

WHAT'S NEW

In Coal-Mining Equipment

PILLOW BLOCK

Randall Graphite Products Corporation, Chicago, offers a universal-type double-reservoir oil-return pillow block which it asserts can be mounted in any position. With this pil-



low block, according to the company, it is necessary only to select the mounting position, unscrew the oil cup, turn the ball to this position and reinsert the oil cup vertically. Oil capacity is said to be three times that of the standard type.

CIRCUIT-BREAKER; SWITCHES

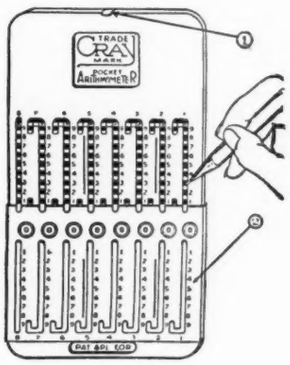
A new oil-blast circuit breaker designated as Type FK-45, with a 75,000-kva. interrupting rating, is announced by the General Electric Co., Schenectady, N. Y. The unit is described as a non-oil-throwing breaker with plate-steel rectangular tank having separating chamber, internal mechanism, silver-to-silver main contacts, easily renewable arcing contacts, oil-blast baffles and Herkolite bushings. It is available in three current sizes: 600, 1,200 and 2,000 amp. The tank construction, it is stated, adapts the breaker to heavy-duty service where space is limited.

A new line of rotating-cam switches, declared to be designed especially for built-in control applications and adaptable to a variety of electrical functions and machine requirements, is another General Electric offering. Bearing the designation CR3300, the switches are available, in non-built - in - applications, as standard switches without the flanges used for flush-mounting on machines. Electrical and mechanical modifications make the units adaptable to applications varying from machine-tool motor control to steel-mill master switching. Sizes are: 0, 15 amp. continuous, and 1, 25 amp., both 600 volts or less a.c.

The rotating-cam switches are available in four types for controlling (1) single-speed motors, reversing application; (2) two-speed separate-winding motors, non-reversing, or one speed forward and one speed reverse; (3) two-speed single-winding motors, non-reversing, or one speed forward and one speed reverse; and (4) three- or four-speed motors for three or four speeds forward and one speed reverse. In addition, special sequences are available, as well as switches with off-position contacts. The switches also can be used as circuit-transfer switches.

POCKET ADDER

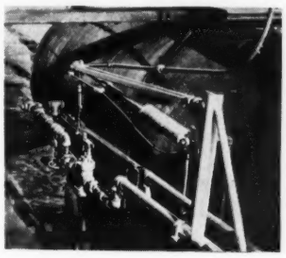
Tavella Sales Co., New York City, offers the "Arithmometer" adding machine, said to be especially designed for carrying in the vest pocket. Features cited by the company,



which guarantees the machine, constructed of cold-rolled steel, for five years, are small size, light weight, accuracy and low price.

FEED-WATER CONTROL

The Campbell - Cantilever boiler-feed-water control, said to be sufficiently sensitive to maintain levels within ½ in., is offered by the J. A. Campbell Co., Long Beach, Calif.



It is made in one size with an over-all length of 48 in. and will operate any valve up to 12 in., according to the company. The control is designed for installation on the side of firebox, return-tubular and water-tube boilers, and can be operated with or without a whistle.

WIRE STRIPPER; WASHER PUNCH

Ideal Commutator Dresser Co., 1013 Park Avenue, Sycamore, Il., offers the Ideal Colonial wire stripper, which it describes as a wire stripper without springs, stripping either from right to left or left to right. A feature pointed out by the company is employment of the principle of centrifugal action, eliminating the necessity for springs and levers. A dialed micrometer gage permits the blades to be closed to within 0.001 in. of the set diameter by a slight pressure on a foot lever. A small switch permits changing from clockwise to counter-clockwise operation when necessary. A stop can be instantly set for any length of stripping up to 2 in.

Ideal also offers a new washer punch for cutting washers out of metal, fabric, gasket material, fiber, steam packing, strawboard, asbestos, leather, felt, cork, rubber, Bakelite, mica and other materials up to 1/16 in. in thickness. With only eighteen hardened dies furnished with the machine it is possible to obtain 150 washer sizes, the company states. Dies are mounted in an eccentric turret plate, thereby placing them all as close to the edge as possible and making it more convenient to center and withdraw washers. The centering system employed is said to assure concentric punching.

Supplementing the No. 5 Model Ideal electric pliers offered some months ago (*Coal Age*, November, 1936, p. 536), the company now offers the No. 10 unit, which is twice the size of the other and is adaptable to soldering lugs up to 1,050 amp. or sweating pipe fittings up to 2½ in. in diameter, continuous operation. Used intermittently, the No. 10 pliers will handle pipe or fittings up to 4 in.

LIGHTING FIXTURES

New mercury-Mazda lighting fixtures combining the light from one 250-watt mercury lamp and either one 300-watt or two 150-watt incandescent lamps to give a soft, diffused light said to provide a high degree of eye comfort and greater pleasure than either mercury or Mazda lamps alone are offered by the Benjamin Electric Mfg. Co., Des Plaines, Ill. Two types of these fixtures are available, both with the same lamp arrangements. Combination diffusers inclose the lamp in an opal-glass diffusing bulb. Apertures in the top of the diffuser reflector permit approximately 10 per cent of the light to reach the ceiling. The same hood construction as the diffuser features the combination dome reflector, but a deeper dome-type reflector is employed, closed at the bottom with a stippled-glass dust-tight cover to keep cool drafts from affecting mercury-lamp efficiency.

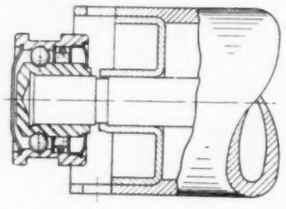
Benjamin also offers the new "Stock-Bin-Lite" reflector, which it describes as a special reflector effectively

solving the problem of uniform lighting for bins, shelves and stacks in stockrooms, tool cribs, etc. These reflectors, it is asserted, provide uniform illumination from the top to the bottom of the tiers and also light the interior of the bins. They are designed for installation in aisles from 3 to 4 ft. wide and are available in sizes accommodating 60-, 75- to 100-, and 150-watt lamps.

A new accessory for lighting fixtures which makes it possible to convert existing reflectors in an overhead lighting system into supplementary lighting units without affecting their efficiency for general illumination is another Benjamin product. Designed to fit RLM dome reflectors accommodating 200- or 300- to 500-watt lamps, the "Beam-Directors" consist of simple auxiliary projectors of etched Alzak aluminum attached inside the reflector skirts. They are recommended by the company for building up illumination over areas 30 to 36 in. in diameter on machines or work benches within 10 to 12 ft. of the reflector to which they are attached.

BEARING

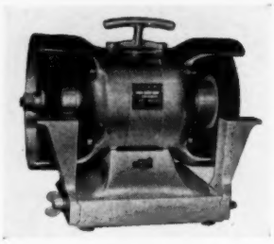
Marlin-Rockwell Corporation, Jamestown, N. Y., offers the "MRC Conv 3" conveyor-roll bearing. This bearing is pressed on the end of the idler shaft as far as it will go, using a special assembly tool, and is removed by a simple puller. Both operations, according to the company, can be done on the job with ordinary labor and without the possibility of dirt or foreign material entering the bearing in the course of replacement. Cost of replacing a bearing, it is stated, need not exceed 10c. The



bearing is featured by a rustproofed "Lubri-Seal" shield, backed by felt (or petrolatum) packing and a spring-controlled cork seal; by slotted sides to permit easy assembly of conveyor rolls in the side frame or mounting bracket; and by a rustproof end cover swedged into the outer ring of the bearing to make a dustproof and watertight joint. Advantages outlined by the company include: 97 per cent fewer bearing replacements; a saving in excess of 30c. per bearing per year through the elimination of lubrication; and elimination of separate closure parts, adjusting nuts, collars, etc., and grease pipes or pressure-gun fittings.

GRINDER

Black & Decker Mfg. Co., Towson, Md., offers a new 6-in. "Junior" ball-bearing bench grinder said to sell at an extremely low price. It is available in all standard a.c. single-phase voltages and cycles, and may be bolted to a bench or moved to convenient locations by means of the carrying handle. Four



rubber feet act as stabilizers. Included as standard equipment are one fine and one medium wheel (6-in. diameter, $\frac{5}{8}$-in. face, $\frac{1}{2}$-in. hole) and a 3-conductor cable. Specifications are: net weight, 31½ lb.; overall spindle length, 12¼ in.; total height, 10 in.; height to center line of spindle, 5½ in.

WELDING ELECTRODE

A new electrode said to eliminate the necessity for multiple-pass welding in the production of fillet and lap welds in many applications and also to permit making such welds without undercutting or overlap is announced by the Lincoln Electric Co., Cleveland, Ohio. Fillet welds up to $\frac{3}{8}$ in. in size, with one plate vertical, can be made in one pass and, according to the company, show no undercutting or overlapping at the horizontal plate. The new electrode bears the designation "Fleetweld 8" and comes in 14- and 18-in. lengths. The 14-in. type is available in diameters of $\frac{3}{8}$, $\frac{5}{32}$, $\frac{1}{4}$, $\frac{3}{16}$ and $\frac{5}{32}$ in., and the 18-in. rod in $\frac{3}{8}$-, $\frac{5}{32}$- and $\frac{1}{4}$-in. sizes.

For flat welding of deep-groove joints, Lincoln also offers the new "Fleetweld 9" welding electrode. High physical properties are noted for the weld deposit, and proper procedure is said to overcome certain conditions frequently encountered in deep-groove welding which tend to cause surface holes in the metal. "Fleetweld 9" is designed for use with either alternating or direct current and is available in 3/16-, ¼- and 5/16-in. sizes.

Lincoln also is revising the engineering drafting-room chart providing in concise form data necessary for the production of arc-welded designs. The original chart was brought out last autumn, and a feature of the new chart is the latest weld symbols adopted by the American Welding Society in May, expected to go a long way in conveying design information to workmen. The chart is 24 in. wide and 35½ in. high. Copies may be obtained by writing the company.

TRUCK BODY

Easton Car & Construction Co., Easton, Pa., offers the new Model W-84-HX "Won-Way" truck body with a water-level capacity of 8 cu. yd., special exhaust location over the cab, crow's nest at the side of the cab for the convenience of the operator in

controlling dumping and backing, and other features. Maximum angle of dump is 50 deg., and the body is elevated by a double telescoping hydraulic hoist. Dimensions are: overall width, 110 in.; inside width, 96 in.; inside length, 138 in.; inside depth, 29 in.; weight, body and hoist, 12,190 lb.

COMPRESSOR CONTROL

Automatic start-and-stop control combined with automatic loading and unloading now are possible without additional equipment on motor-driven single-horizontal compressors, states the Worthington Pump & Machinery Corporation, Harrison, N. J., in introducing its new magnetic unloader. The unit, it is said, can be installed wherever a conventional automatic starter is employed, and requires only a pressure switch to operate a pilot circuit. The pressure-switch control is transferred electrically from the starter to the magnetic unloader, and either position can be selected at will, permitting either start-and-stop operation of the compressor or continuous operation with automatic loading or unloading. If desired, the cooling-water supply also may be controlled automatically.

SCRAPER

Bucyrus-Erie Co., South Milwaukee, Wis., offers a new four-wheeled tractor-powered scraper for excavating, dumping and spreading earth in excavation work. The scraper, according to the company, can be maneuvered in a complete circle within the radius of its own length. All four wheels are inside the path of the cutting edge, enabling the unit to dig full width in close quarters and to cut right up to banks or other obstructions. Operation of the scraper is regulated by an easy-running single cable from a drum power unit on the tractor. The scraper is manufactured in 4½- and 7-cu.yd. level-full sizes.

EXCAVATOR

Harnischfeger Corporation, Milwaukee, Wis., announces the new Model 855 2-cu.yd. "Pacemaker" excavator, which it characterizes as a high-speed unit in an all-welded construction employing new alloy steels for greater strength and rigidity with less weight. The unit is fully convertible as a shovel, dragline, crane or clamshell. The standard "live" shovel boom is 25 ft. long. The dragline boom, in two sections and easily extended on the job, is 60 ft. long. In soft ground, provision has been made for removing the corduroy frames and extending the length of the caterpillars when operating as a dragline. Gasoline, electric or 8-cylinder Fairbanks-Morse diesel power are available. Hoist-line speed is 141 f.p.m. and pull is 26,000 lb.